Research Article

# Effect of Early Weaning on Performance Traits and Health Parameters of Bonsmara Bull Calves in a Backgrounding Program

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**Abstract** | Backgrounding is a post-weaning growing program aimed at adding muscle and skeletal growth of the calves prior finishing phase. This research aimed to determine the influence of early weaning of Bonsmara bull calves on the performance traits and health parameters in a backgrounding program. A total of two-hundred and eighty-six (n = 286) Bonsmara bull calves were divided into two weaning strategies of early weaned calves (EWC) (n = 136) ranged from 144 to 219 kg and traditionally weaned calves (TWC) (n = 150) ranged from 221 to 295 kg. Calves were fed *ad libitum* with 3% body weight (BW) protein-energy supplementation while grazing *Eragrostis Teff* grass. Performance traits including initial body weight (IBW), end body weight (EBW), dry matter intake (DMI), average daily gain (ADG) and feed conversion ratio (FCR) were evaluated. Morbidity, mortality and case fatality rates were evaluated as health parameters. The EWC group exhibited significantly lower IBW (52 kg; P <0.001) and EBW (54 kg; P <0.001) compared to TWC group. However, no significant differences were observed in DMI (P = 0.952), ADG (P = 0.205), or FCR (P = 0.885) between the two groups. The EWC group showed higher morbidity (18.38% vs. 6%) but lower mortality (0% vs. 0.67%) compared to the TWC. Conversely, the TWC group had a higher case fatality rate (11.11%). Although EWC group had a lighter body weight, their growth performance was comparable to TWC group. Early weaning may present a viable strategy for backgrounding, with careful management of health risks.

**Keywords** | Early weaning, Backgrounding, Bonsmara cattle, Bull calves, Performance traits, Health parameters

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## INTRODUCTION

During the period of drought when the forage quantity and quality declines, the cow-calf producers commonly use early weaning strategy to reduce grazing pressure on pasture, reducing nutrient requirements and restoring body condition of the cows for the next breeding season (Rasby, 2007). The earlier the weaning occurs, the higher the possibilities of the cows to becoming pregnant within the first weeks of the breeding season (Alforma *et al*., 2023). Early weaning is defined as a separation of calves from their dams at less than 180 days of age and it can be performed with calves as young as 45 days (Rasby, 2007). However, this practice may result in lower calf value at weaning compared to calves weaned conventionally (Story *et al*., 2000). A backgrounding program is an intermediate post-weaning growing program that links cow-calf and feedlot sectors and provide additional weight and value to calves (Peel, 2006). According to Pethick *et al*. (2004) this management practice is aiming to add muscle and frame to smaller calves prior to finishing, in order to achieve optimal slaughter weights. A major determining factor of feeder cattle is a calf size (small, medium and heavy weight) upon weaning and finishes at different beef standard rates (Dolezal *et al*., 1993). According to Fourie and Matli (2014) it was evident that backgrounding beef calves involves growing of weaned calves ranging from 160 to 190 kg and indicated that most of the backgrounding farmers (60%) prefer marketing their calves at 240 to 260 kg. However, based on the authors' knowledge there are no conclusive studies on influence of early weaning on performance traits and health parameters of Bonsmara Bull Calves in a backgrounding program. The objectives of this study were to 1) Determine the effect of early weaning of Bonsmara bull calves on the performance traits including the initial body weight, end body weight, dry matter intake, average daily gain, feed conversion ratio and 2) Determine the effect of early weaning on the health parameters which includes morbidity, mortality and case fatality rates of Bonsmara bull calves.

## MATERIALS AND METHODS

### Description of the Study Area

A cattle backgrounding trial was conducted from Mid-October to Late-November in 2023 at Sparta Clocolan farms situated 15 km West of Clocolan, Free State province of South Africa, on 28°53' 45.29600" S latitude, 27°28'49.85815" E longitude. The area is situated at an elevation of 1573.6 m above sea level with an annual rainfall of 387mm. The average summer temperature ranges from 14.8 to 25.4 $^{0}$C and the average winter temperature ranges from 2.8 to 14.8 $^{0}$C (Weather Atlas, 2024). The town is on the eastern part of the Free State in the Thabo Mofutsanyane District under Setsoto local municipality. Alma and Ascot are the Sparta farms where calves are backgrounded and are also used as a feedlot satellite when there is water shortage at Sparta Feedlot.

### Experimental Animals and Sample Size

Two-hundred and eighty-six (n = 286) Bonsmara bull calves were purchased in the normal course of the business, being sourced from different reputable stud breeders. These calves were used as sample size. The sample size for the current study ($n$ = 286) was decided based on the study of Jaeger *et al*. (2022) and Hodder *et al*. (2023) who used $n$ = 239 and $n$ = 250, respectively. These bull calves were divided into two weaning strategies such as early and traditionally weaned calves. The early weaned calves (EWC) (n = 136) ranged from 144 to 219 kg with an average weight of 196 ±18.0 kg (early weaned calves - EWC), while traditionally weaned calves (TWC) (n = 150) ranged from 221 to 295 kg with an average weight of 248 ±18.9 kg.

### Animal Management

The receiving protocols used upon the day of arrival on the farm were in line with that of Hodder *et al*. (2023). Briefly, calves were allowed 24-hour relaxation before they were processed and the processing of calves included weighing and sorting, vaccination, taking rectal temperature, ear tagging, growth-promoting implant, dehorning and branding were followed. Additionally, ear tags were placed on both ears for identification and management purposes (Figure 1).


**Figure 1: A:** position of animal identification (ID) tags on both ears; **B:** ID tags off the ears. Purple plain tag (trial identification), colour tag (colour month, big number is week number and small number is channel or source of calf) and high –frequency electronic tag.

**Table 1:** Nutritive VALUE of the *Eragrostis Teff* grass used in the backgrounding program.

| Parameters | Percentages (%) |
|---|---|
| Moisture | 5.54 |
| Protein dry basis | 11.2 |
| Fat dry basis | 0.98 |
| Fiber dry basis | 32.62 |
| Ash dry basis | 4.99 |
| ADF dry basis | 41.65 |
| NDF dry basis | 71.07 |
| Phosphorus as is basis | 0.07 |

### Feeding Management

Calves were allocated into two different camps of *Eragrostis teff* and were backgrounded for a period of thirty-seven (37) days. Table 1 is presenting the nutrient content of *Eragrostis teff*. The analysis revealed that the pasture contained 71.07% NDF, 41.64% ADF, 32.62% fibre, 11.20% protein, 5.54% moisture, 4.99% ash and smaller amounts of fat and phosphorus at 0.98% and 0.07%, respectively. Calves were introduced to a starter ration (Table 2) *ad libitum* for a period of ten (10) days and spent the remaining days on grower ration (Table 3). The diet was formulated based on NRC (1996) to achieve 1.44 Mcal $NE_m$/kg, 13% CP and minimum recommended levels of minerals and vitamins.

**Table 2:** The composition and nutritive value of the starter ration fed in backgrounding program.

| Ingredients | Grams/head | Percentages (%) |
|---|---|---|
| Molasses | 150 | 3 |
| Hominy chop | 2010 | 40.20 |
| Sunflower oilcake | 350 | 7 |
| Corn silage | 1300 | 26 |
| Bran | 350 | 7 |
| Teff grass (milled) | 380 | 7.60 |
| Background HPC | *460* | 9.20 |
| Total | *5000* | 100 |
| **Background HPC contents** | | |
| Premix chop | 85.25 | 18.53 |
| Salt | 180 | 39.13 |
| Lime | 120 | 26.09 |
| Urea | 70 | 15.22 |
| SM44 – Compound | 1.85 | 0.40 |
| Grower Premix | 3 | 0.65 |
| Total | 460 | 100 |

**Moisture:** 12.47%; Crude Protein = 11.83%; ADF = 14.15%; NDF = 33.35%; ADL = 3.95%. The Energy content expressed in Mcal/MJ/kg: TDN = 52.46 DM%; ME = 7.92 MJ/kg; $NE_{M}$ = 1.27 Mcal/MJ/kg; $NE_g$ = 0.0.85 Mcal/MJ/kg. Protein = 10.7%; Fat = 5%; Fiber = 11.73%; Ash = 6.28%; Calcium = 0.74%; Phosphorus = 0.35%.

### Collection of Performance Traits

The animals were individually weighed using a Silencer hydraulic chute with scale calibrated at 280 kg of certified weights before use (Smock *et al*., 2021). Body weight (BW) of each animal was recorded during processing of new arrivals at the beginning and end of the backgrounding phase using the inspected, permanent weighing and handling facilities (Smith *et al*., 2015). Initial body weight (IBW) and ending body weight (EBW) of each group were measured at the beginning and conclusion of the backgrounding program. Dry matter of feed samples was used to compute the average daily DMI from the average daily feed intake (ADFI) data (Abitante *et al*., 2024). Average daily gain (ADG) for individual steers was calculated as coefficient of a linear regression of body weight against time of the data points (Abitante *et al*., 2024). Feed conversion ratio (FCR) was determined as gain: feed ratio.

### Collection of Health Parameters Data

The number of morbidities and mortalities were recorded on daily basis along with their identification tags, diagnoses, quantity of and medication used. Table 4 represents how the morbidity, mortality and case fatality rates were determined. The diagnosis was based on the visual detection of clinical signs such as nasal discharges, dry or wet muzzle, depression, fever and poor condition of the calf as explained by McMullen *et al*. (2019). The dead calves were weighed and examined, with an assessment of the internal organs conducted.

**Table 3:** The composition and nutritive value of grower ration fed in backgrounding program.

| Ingredients | Grams/head | Percentages (%) |
|---|---|---|
| Hominy chop | 2200 | 33.85 |
| Sunflower oilcake | 500 | 7.69 |
| Corn silage | 2700 | 41.54 |
| Bran | 450 | 6.92 |
| Molasses | 190 | 2.92 |
| Background HPC | *460* | 7.08 |
| Total | *6500* | 100 |
| Background HPC content | | |
| Premix chop | 85.25 | 18.53 |
| Salt | 180 | 39.13 |
| Lime | 120 | 26.09 |
| Urea | 70 | 15.22 |
| SM44 – Compound | 1.85 | 0.40 |
| Grower Premix | 3 | 0.65 |
| Total | 460 | 100 |

**Moisture:** 21.53%; Crude Protein = 11.83%; ADF = 4.56%; NDF = 18.37%; ADL = 1.05. The Energy content expressed in Mcal/MJ/kg: TDN = 48.40 DM%; ME 7.28 MJ/kg; $NE_{M}$ = 1.18 Mcal/MJ/kg; $NE_g$ = 0.80 Mcal/MJ/kg. Protein = 9.38%; Fat = 3.39%; Fibre = 6.37%; Ash = 3.61%; Calcium = 0.74%; Phosphorus = 0.32%.

### Statistical Analysis

The statistical analysis software (SAS, 2023) version 9.4 was used for analysis. All the collected data was tested for normality using Shapiro–Wilk's test before analysis (Shapiro and Wilk, 1965). The student T-Test was used for analysis of variance between two weaning strategies in performance traits and health parameters. The significance levels were observed at $p < 0.05$.

## RESULTS AND DISCUSSION

The backgrounding and feedlot farmers are struggling to recognize the benefits of EWC or lighter calves, especially in the cattle feeding operations, this is evident through conflicting reports of effects in finishing on average daily feed intake and the feed efficiency potentially due to the confounding effects of body size and growth potential

(Myers *et al*., 1999b; Barker-Neef *et al*., 2001; Arthington *et al*., 2005; Scheffler *et al*., 2014). It is important to unfold on the results of EWC vs TWC on their performance traits and health parameters thereby determining productive benefits.

**Table 4:** The presentations of the formulas in determining the production traits and health parameters.

| Parameters | Formula |
|---|---|
| **Production traits** | |
| Average IBW | Total IBW/ number of animals in the group (*n*) |
| Average EBW | Total EBW / number of animals in the group (*n*) |
| ADG | (EBW – IBW) / Total number of days in program |
| ADFI (AS IS) | Total fed/ quantity of animals in group |
| DMI | ADFI - Moisture% |
| FCR | DMI / ADG |
| **Health parameters** | |
| Processing Morbidity % | Quantity treated/Quantity in group ×100 |
| Backgrounding treatments % | Quantity treated in backgrounding/Quantity in group ×100 |
| Respiratory morbidity % | Quantity treated for respiratory infections/ Quantity in group ×100 |
| Digestive treatments % | Quantity treated for digestives/Quantity in group ×100 |
| Backgrounding relapse % | Quantity relapsed/Total treatments ×100 |
| Overall morbidity % | Total treatments/Quantity in group ×100 |
| Mortality % | Quantity of deaths/Quantity in group ×100 |
| Case fatality rate % | Quantity of death/ Quantity of treatments ×100 |

The means of the treatments, initial and end BW (IBW and EBW), dry matter intake (DMI), average daily gain (ADG) and feed conversion (FCR) are presented in Table 5. The IBW and EBW for EWC were significantly lighter ($P < 0.05$) than that of the TWC (196 vs. 248 kg and 254 vs. 308 kg), respectively. The EBW of EWC and TWC increased by 29.59% and 24.19%, respectively. The EWC were 52 kg (26.53%) and 54 kg (21.26%) lighter than traditionally weaned calves (TWC) at beginning and the end of the backgrounding program, respectively. The percentage difference of 5.40% between EBW and IBW, shows the potential effect of EWC to convert feed more efficiently and effectively. This could be evidence of compensatory gain, given the expectation that calves experiencing a period of slow growth due to nutritional stress induced at early stages of life may regain BW once nutritional conditions are restored (Arthington *et al*., 2005). It was hypothesized that early weaned calves will need longer standing days to achieve the desired feedlot entry weight of 200-260 kg and this will result in increased costs of feeding, high morbidity and mortality in backgrounding program.

**Table 5:** The means, standard deviations (±) and the *P*-values of the production traits.

| Performance traits | EWC | TWC | P values |
|---|---|---|---|
| Initial BW (kg) | 196[a] ±18.0 | 248[b] ±18.9 | <0.0001 |
| Ending BW (kg) | 254[a] ±28.4 | 308[b] ±23.5 | <0.0001 |
| DMI (kg) | 4.17[a] ±3.60 | 4.22[a] ±3.98 | 0.952 |
| ADG (kg) | 1.59[a] ±0.49 | 1.66[a] ±0.41 | 0.205 |
| FCR DM (kg) | 2.62[a] ±2.26 | 2.54[a] ±2.39 | 0.885 |

[a, b] Means with different letters within the same row differ significantly at $P < 0.05$.

These results are consistent with those reported by Arthington *et al*. (2005) that EWC were lighter ($P = 0.03$) at normal weaning than normal weaned calves (221 vs.269 kg; 21.72%) and they tended to be lighter ($P = 0.12$) at 28-day period (242 vs. 282 kg; 16.53%). Wolcott *et al*. (2010) also reported that EWC were significantly lighter ($P < 0.001$) than their conventionally weaned contemporaries through backgrounding and finishing. The results of this study are similar to those of Abitante *et al*. (2024) who found that early weaners (EW) were approximately 44 kg lighter than conventional weaners (CW) and that weight difference had no influence on the ADG, DMI and FE in finishing phase. The findings are also supported by Wolcott *et al*. (2010) who reported that the weaning treatment did not affect feed efficiency whether measured as RFI ($P = 0.64$) or feed conversion ratio (FCR) ($P = 0.27$). The BW difference which persisted throughout backgrounding program may be the results of an additional milk intake period by TWC group which may represent an advantage in terms of BW during this interval. The results of this study are in contrast with those of Smith *et al*. (2015) and other researchers (Lusby *et al*., 1990; Barker-Neef *et al*., 2001; Schoonmaker *et al*., 2001; Schoonmaker *et al*., 2004; Meyer *et al*., 2005; Waterman *et al*., 2012; Scheffler *et al*., 2014) who reported that EW steers were consistently heavier upon completion of *ad libitum* access of early concentrate feeding period than CW steers which remained un-supplemented with their dams.

In keeping with the consistent effect of weaning treatment on the live weights, there were no significant effects of weaning treatment on the DMI ($P = 0.95$), ADG ($P = 0.21$) and the FCR ($P = 0.89$) between the groups (Table 5). Both EWC and TWC calves had *ad libitum* access to the same diet and period in backgrounding phase. The DMI of EWC was 1.20% (4.17 vs. 4.22) lower than that of TWC and these results are similar to those of Terblanche *et al*. (2020) who found no differences between the percentage feed intake of Bonsmara heifers (2.46%) and bulls (2.40%). NRC's (2000) intake values were 2.50 to 2.70% for cattle between 250 and 360 kg. Even though TWC had a slightly higher DMI than their counterparts in this study, their improvement in ADG resulted in improved FCR.

The current study indicated that there were no significant differences (P = 0.89) in feed conversion ratios (FCR) between the groups, but the FCR of TWC was 3.15% (2.54 vs. 2.62 kg) slightly better than that of EWC. Based on the targeted supplementation intake of 6 kg (3%), EWC had relatively lower residual feed intake (0.69 kg) than TWC with the residual feed intake of 2.02 kg. EWC were expected to consume 5.88 kg, but they consumed 5.19 while TWC were expected to consume 7.44 kg, but they only consumed 5.44 kg during backgrounding. Our study indicated that EWC consumed 0.25 kg (4.82%) less feed than TWC. These results are similar to those found by Wolcott *et al.* (2010) that early weaned animals tended to eat less feed than their conventionally weaned contemporaries.

According to Ball *et al.* (2015) and Beck *et al.* (2016), most of the backgrounding operations have a goal of achieving ADG of 0.68 kg per day or greater. However, both groups exceeded the expected ADG target of 0.60 kg, by 2.65 and 2.77 times more for EWC and TWC, respectively. The average daily gain (ADG) in this study was 1.59 and 1.66 kg for EWC and TWC, respectively and they did not differ significantly, but ADG for TWC was 4.40%; slightly higher than that of EWC. Smith *et al.* (2015) supported the results of this study that ADG in backgrounding for EWC was consistently lower than that of CW steers within the treatment by season and treatment by year interaction. Landblom *et al.* (2006) also reported that the weaning weights for normally weaned steers were heavier than early weaned calves at the end of backgrounding phase (P<0.01) and had greater ADG and ADFI than EWC, but EWC were more efficient than TWC. The results in this study support the statement by Bergh *et al.* (2010) that the large gene pool of this indigenous breed (Bonsmara) allows for sufficient variation and performs equally well on grazing and in feedlots.

Defiantly, Fluharty *et al.* (2000) reported that EW steers gained 0.46 kg per day more than TW weaned steers during the time period leading up to traditional weaning when were compared at two different weaning ages (EW, 103 d; TW, 203 d). The results from this study varied from that of Blanco *et al.* (2009) who reported that ADG of EWC was 42% higher than that of TWC and they were 22 kg heavier at 150 days.

The lighter body weight observed in the EWC group indicate that they require more days in the backgrounding program to reach the desired feedlot entry body weight. However, this statement supports the hypothesis that early weaned calves require longer days to achieve the desired feedlot entry weight of 200-260 kg. Surprisingly, the results showed that statistically, there was no significant difference in terms of DMI, ADG and FCR although there was a slight difference in favour of the TWC group. Therefore, this study demonstrates that following the immediate weaning weight (196 and 248 kg), EWC can perform comparably well compared to their counterparts throughout the backgrounding phase. This outcome could be attributed to reduction of stress from abrupt weaning, facilitated by the adoption of feeding strategies such as introduction of starter and grower rations, and the creep-feeding (Myers *et al.*,1999b; Lardy and Maddock, 2007). The results are consistent with the hypothesis that the TWC group will show higher feed intake and better feed conversion ratio, resulting in better average daily gain than early weaned calves.

**Table 6:** The quantity and percentages (%) of animal health parameters in a backgrounding program.

| Health parameters | EWC (%) | TWC (%) |
|---|---|---|
| Processing treatments[1] | $\left(\frac{19}{136} \times 100\right) = 13.97$ | $\left(\frac{8}{150} \times 100\right) = 5.33$ |
| Backgrounding treatments[2] | $\left(\frac{6}{136} \times 100\right) = 4.41$ | $\left(\frac{1}{150} \times 100\right) = 0.67$ |
| Backgrounding relapse[3] | $\left(\frac{2}{19} \times 100\right) = 10.53$ | 0 |
| Overall Respiratory morbidities[4] | $\left(\frac{22}{136} \times 100\right) = 16.18$ | $\left(\frac{9}{150} \times 100\right) = 6$ |
| Overall Digestive morbidities[5] | $\left(\frac{3}{136} \times 100\right) = 2.20$ | 0 |
| Overall Morbidities[6] | $\left(\frac{25}{136} \times 100\right) = 18.38$ | $\left(\frac{9}{150} \times 100\right) = 6$ |
| Respiratory mortality[7] | 0 | $\left(\frac{1}{150} \times 100\right) = 0.67$ |
| Case fatality rate (%)[8] | 0 | $\left(\frac{1}{9} \times 100\right) = 11.11$ |

[1]Processing treatments respiratory related due to high rectal temperature (>37.4); [2]Treatments during backgrounding program; [3]Quantity of calves retreated in Backgrounding from the processing treatments; [4]Total respiratory morbidities in backgrounding program; [5]Total digestive morbidities in backgrounding program; [6 = (4+5)] Total morbidities in backgrounding program; [7]Respiratory deaths without treatment; [8]Case fatality (number of deaths/ number of treatments timesx100) norm < 10% (According to Sparta Veterinary Consultant, Mapham, 2018, personal communication).

## Animal Health Parameters

Table 6 is presenting the health parameters of both groups from processing and during backgrounding program. During processing of new calves, processing treatments were regarded as respiratory related symptoms and EWC were 2.38 times (19 vs. 8; 13.97 vs. 5.33%) higher than that of their counterpart. High processing morbidity of EWC may be an indication of distress which is arousing from the nature of early weaning – shorter suckling period, exposure to stressful management practice (vaccination) and most importantly shipping stress while their lighter and weaker. Similarly, Smith *et al.* (2003) reported that steers that were EW at four months of age displayed more distress associated with weaning than their contemporaries that were CW at seven months of age. Earlier on this study, it was hypothesized that because of weaning and post-weaning stress, early weaned calves will show high rate of respiratory morbidities and mortalities.

The backgrounding morbidity for EWC and TWC was 4.41% and 0.67%, respectively and only 10% of EWC were relapsed from the processing treatments. The results in this study indicated that the overall respiratory related morbidity reported in backgrounding phase for EWC was 16.18% and TWC had 6%. According to Nickell and White (2010) the estimated incidence rate of bovine respiratory disease (BRD) must be at least 25% fometaphylaxis program to be cost effective. The overall rate of digestive treatments in the backgrounding program was 2.20% which was for EWC and this observed percentage of digestives in EWC could be attributed to the adaptation of the calves' gastrointestinal tract to the new diet. In their study, Myers *et al.* (1999a) reported a small incidence of digestive morbidity (7%) that did not differ between calves weaned at 90 or 215 days of age.

The overall morbidity percentage of EWC and TWC was 18.38 and 6, respectively, and the former being 3.06 times higher than the latter group. The results in this study indicated that EWC calves were 2.57 and 3.06 times more likely to be diagnosed with respiratory related symptoms and the overall morbidity in backgrounding program, respectively. Similar results were further supported by Gummow and Mapham (2000) and Step *et al.* (2008) who reported that calves weighing less than the mean BW were 1.4 times more likely to be diagnosed with BRD than those that weighed more than the mean BW of the group. The results in this study indicates that EWC falls under high risk category and this was supported by (Bateman *et al.*, 1990; Taylor *et al.*, 1999; Gummow and Mapham, 2000; Sanderson *et al.*, 2008) that light-weight calves were at greater risk than heavier ones.

Sanderson *et al.* (2008) reported similar results that calves that are heavier at arrival were associated with a decreased morbidity. They found that calves weighing more than 318 kg less likely to be diagnosed with BRD than calves weighing less than 250 kg (RR = 0.18, $P < 0.00$). Pinchak *et al.* (2004), evaluated several groups of stocker calves and found that there was an association between BW and BRD, with lighter calves having a greater incidence of BRD. The lighter calves at arrival could have been younger than their heavier counterparts. It can therefore, be speculated that lighter calves could have been exposed to potential pathogens and given an opportunity to build up immunity to those pathogens.

The mortality percentage of TWC was 0.67% and the case fatality rate was 11.11% which was 1.11% higher than the 10% norm (Table 6). However, there was no mortality reported in EWC even though they possess a high morbidity percentage. These results are supported by the conclusion made by Smith *et al.* (2015) that EWC are better equipped to handle the stressors incurred throughout the various proceeding management phases, potentially due to an enhanced immune system. On the early days (4$^{th}$) of backgrounding, one calf from TWC group died due to respiratory disease and it was not treated. The results of untreated dead calf in TWC, may be due to lacking of respiratory clinical symptoms and the good looking body condition of the calf. Due to a high morbidity rates observed in EWC group, less attention was given to TWC group. Another factor that aggravated lower mortality in EWC group is the good weather conditions of the season during which the trial was conducted. A warmer and rainy weather conditions which results to the good grass quality and quantity. However, the mortality of EWC group could have been worse if the study was conducted during winter season.

According to Enriquez *et al.* (2011) and Taylor *et al.* (2019) weaning of beef calves from their dams is widely recognized as a stressful event. Weaning has entailed abrupt separation of calves from their dam, often with immediate shipment and sale. Combining weaning with other stressors is considered as a contributing factor to development of bovine respiratory disease (BRD) (Taylor *et al.*, 2010). The source of weaning stress is likely multifactorial and includes the loss of nutritional support through milk, disruption of social bonding with the dam, increased social stress as calves seek to establish dominance in a population lacking adults and impacts of introducing to a novel environment (Enriquez *et al.*, 2011). However, in early weaned beef calves, these multifactorial stressors may be more detrimental and contribute to or worsen the health outcomes in the subsequent segment.

The younger they are weaned, the more difficult it is for them to cope with the physiological, nutritional, physical (Lynch *et al.*, 2019), and immunological challenges (Teixeira *et al.*, 2021b). According to Enriquez *et al.* (2011) one of the greatest challenges is dietary transition. If the process of ruminal development does not occur properly, early weaning can impair the development of calves (Steele *et al.*, 2016), resulting in poorer performance compared to calves weaned at a conventional age (Rasby, 2007).

Another factor that may contribute to reduction in ADG after weaning is their behaviour in consequence to weaning stress (Teixeira *et al.*, 2021a). Calves weaned at an early age (30 and 75 days) were found to be more active than those weaned conventionally. This increased activity was characterized by more time spent walking and vocalizing, as well as reduced feeding time (Teixeira *et al.*, 2021a), which reduces feed intake and could help explain the variation in body weight. These behavioral patterns are indicators of stress and can influence feed intake and weight gain (Price *et al.*, 2003).

High-frequency tags contain important data such as calf origin, vaccination and treatments data, the initial and current body weight, and ADG. Some tags are missing and need to be replaced with other tags, with which if there is a discrepancy, can affect the quality of the data and quantity of animals per group. Removal of wet feed during rainy weather can affect the overall quantity of feed fed even when weighed at the time of removal. However, early weaned calves have the potential to experience higher morbidity and mortality than their counterparts due to multifactorial stressors which may show a biasness in this study.

The sample size was supposed to be 150 animals per group, but due to lack of lighter Bonsmara calves, only 136 calves were available and came from the same sources.

## CONCLUSIONS AND RECOMMENDATIONS

The study assessed the effects of early weaning of Bonsmara bull calves on performance and health parameters in a backgrounding program. The study suggests that early weaning practice affects the body weight of calves. The study also suggests that the calves' health should be of a greater concern even though no mortality was recorded. It is advisable that farmers should consider backgrounding conventionally weaned calves due to their heavy body weight and lower morbidity incidences. This study was limited to Bonsmara bull calves grazing *Eragrostis teff* pastures. Further research can be extended to Bonsmara steers, other breeds and seasons of the year.

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## NOVELTY STATEMENTS

This is the first study to report that the weaning treatment had no effect on the DMI, ADG and FCR, and that the EWC group were more susceptible to diseases than TWC group.

## AUTHOR'S CONTRIBUTIONS

Fourie Pieter: Conceptualization, Methodology, Validation, Writing - original draft, Writing – review and editing, Visualization, Supervision, Project administration, Funding acquisition.
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All authors reviewed and approved the final manuscript.

### Conflict of Interest

The authors have declared no conflict of interest.

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