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Benefits of Preconditioning Beef Calves Compared to the Traditional Marketing Practice

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Abstract: Preconditioning is a management practice used by beef farmers on the farm for enhancing health and nutrition of beef calves. It has the potential to bring higher economic returns for cow-calf producers from feeder calves if preconditioning is cost-effective. The objective of this study was to find out the price differences between traditional marketing and value added marketing (preconditioning or board sales) of beef calves in the state of Alabama from 2012-2016. The sales data were collected from the USDA-AMS (Agricultural Marketing Service) field office at Montgomery, Alabama, for both traditional marketing (auctions) and value added marketing (board sales). There were 21 locations for traditional marketing while board sales data were collected from 3 locations. Of the total calf sales, only 23% calves were sold through board sales. Sales data were collected from 585 lots representing 118,125 head of calves sold between January 2012 and December of 2016 at different auctions and board sales. The data consisted of auction types, gender, muscle scores and average weight (range: 250-386 kg), however, the breeds of feeder calves were not considered. Data were analyzed using the general linear model procedures of SAS (SAS Inst., Cary, NC) to determine the price difference associated with sales type including all variables listed above. However, the economic values of preconditioning were not determined. The results showed that beef calf prices differed significantly ($p<0.05$) between market types (auction vs. board sales), years, gender, muscle scores and average weights. The overall yearly price averages were \$2.64, \$3.00, \$4.62, \$4.51 and \$2.75 kg^{-1} of live weight for years 2012, 2013, 2014, 2015 and 2016, respectively. When values for market types (auction and board sales) were combined, the average prices for Muscle Scores (MS) were \$3.58, 3.67, 3.47 and 3.29 kg^{-1} for MS 1, MS 1 and 2 combined, MS 2 and MS 3, respectively. The year 2014 was the best year for beef calf prices in Alabama regardless of auction types. The results of this study suggest that there are price differences between the traditional marketing and board sales (preconditioning) of calves. However, the net profits due to marketing strategies needs to be investigated further to demonstrate the economic benefits of preconditioning calves, especially to small producers.

Key words: Preconditioning, traditional marketing, beef calves, economic return, demonstrate, enhancing

INTRODUCTION

The cattle industry in the United States has over 900,000 producers with 93.5 million head of cattle (Anonymous, 2017b). In 2016, 30.5 million head were slaughtered, producing 25.2 billion pounds of commercial carcass and the cash receipts totaled \$67.56 billion (Anonymous, 2017b). In Alabama, there were 1.3 million head of cattle and Alabama ranked 16th in terms of number of beef cattle and 8th in the number of farms with beef cattle (Anonymous, 2017a). Cattle production in the United States, primarily, consists of three different sectors: cow-calf operations, stocker cattle/backgrounding and feeder cattle. Alabama cattle production is mainly composed of small cow-calf operations. Most of the cow-calf producers in the state of Alabama have on average 40 brood cows (Anonymous, 2014). This trend is not only specific to Alabama as 82% of the beef farms in the United States have <50 head of brood cows. Many of the cow-calf producers in Alabama rely on another source of income as cow-calf production requires less time. Currently, producers have calves at different times due to a lack of a strict breeding and calving season.

Many small cow-calf producers are currently marketing calves year-round at the time of weaning. This practice can be attributed to lower market prices and possibly a less efficient animal as the morbidity rate will likely increase in the next stage of production. However, cow-calf producers can adopt management practices that could produce healthier and more valuable calves. Producers create these value added calves by completing additional management practices

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(i.e., weaning, castration, dehorning, deworming and vaccinations). Preconditioning calves is not a new concept but research has provided mixed results and many producers have not accepted the new practice. By participating in a preconditioning program, producers can experience several price premiums at the time of marketing. Some of the most common premiums a producer can experience are a seasonal premium as the calves would be sold at one time, lot size premium and a management premium.

Preconditioning calves requires that the producer keep the calves for an additional 30, 45 or 60 days after weaning along with completing some additional management practices (Dhuyvetter *et al*., 2005; Donnell *et al*., 2007; Raper *et al*., 2011).The most common preconditioning program that is commercially marketed is the VAC (Value-Added Calf) 45 program (Avent *et al*., 2004). All preconditioning programs have similar basic management practices. At the time of birth, each calf should be given an ear tag or identifier which will allow the producer to accurately record that the calf has undergone the entire preconditioning program. Additionally while the calf is young and easy to handle, the producer should complete two more management practices that can become more difficult and stressful as the animal gets larger. The first practice is to castrate all bull calves and the second practice is to dehorn all calves. These management practices are less stressful for the animal at the younger age. Dehorning is important for the safety of future handlers and other animals the calf is coming led with in the later stages of production (RSPCA., 2017). Castrating bull calves results in better performing animals in later stages of production. The calves should also be vaccinated 21-30 days pre-weaning with a IBR-PI3-BVD-BRSV vaccine. At the time of weaning, another round of vaccines should be administered similar to the pre-weaning vaccines. Calves should also be dewormed to ensure they have the best opportunity to perform efficiently.

Preconditioned calves have consistently sold at higher market prices; however, there is a large amount of variation between most of the studies. Crozier and Rood (2012) found that preconditioned calves returned $14.00/head. While Donnell *et al*. (2007) found that there was $57.31 net return per head and Raper *et al*. (2011) found the return to be approximately $35.37/head. The returns received by a producer are influenced by several other factors, many of which cannot be accounted for inany single study.

MATERIALS AND METHODS

Data collection: The project did not require any approvals from the Tuskegee University Institutional Animal Care and use committee and Tuskegee University, human participant review committee because no animal and human subjects were involved in the project. The data were collected from the United States Department of Agriculture, Agricultural Marketing Services (USDA-AMS) in Montgomery, Alabama. The USDA-AMS Field Office in Montgomery is responsible for collecting agricultural sales data for the entire Southeast. Data normally collected at cattle livestock sales (board sales and local auctions) include: average prices, weights, frame scores, Muscle Scores (MS) and lot sizes. The previous listed data are collected at all cattle sales (board sales and auctions) in the entire Southeast; however, we only collected data from board sales and auctions in the state of Alabama on average weights, price, muscle scores and lot sizes. Data were collected from 21 traditional auctions, the avenue many cow-calf producers choose to utilize and three board sales which market preconditioned calves.

Following the data collection, it was decided to exclude any calves sold that did not fall in the weight range of 250-386 kg. The excluded weights were not represented in both board and auction sales. The final data used represented 585 lots representing 118,125 head of cattle sold between January, 2012 and December, 2016. The final data also consisted of 45,457 head of heifers, 9,247 of which were sold via. board sales and 36,210 were sold through auctions. Heifers marketed through board sales were further broken down into muscle scores: heifers with a MS 1 represented 1,454, MS 1 and 2 represented 7,709 and MS 2 represented 84 head of heifers. Auction heifers were classified by MS: MS 1 represented 11,664, MS 1 and 2 represented 476, MS 2 represented 16,718 and MS 3 represented 7,352 head of heifers. Steers composed 40,600 head of cattle of which 17,955 were sold through, board sales and 22,645 were sold through various auctions throughout the state. Board sales steers with a MS 1 represented 3,596, MS 1 and 2 represented 14,136 and MS 2 represented 223 head of steer, respectively. Auction steers with a MS 1 represented 9,930, MS 1 and 2 represented 497, MS 2 represented 9,600, MS 2 and 3 represented 19 and MS 3 represented 2,599 head of steer, respectively. Bulls were composed of 32,068 head of cattle which were only sold through, auctions as they do not have a castration requirement. Bulls with a MS 1 represented 9,854, MS 1 and 2 represented 13, MS 2 represented 15,307 and MS 3 represented 6,894 head of bull calves, respectively.

Data and statistical analysis: Data were analyzed using the GLM procedure of SAS (SAS Insti. Inc., Cary, N.C., USA) using weighted least squares. Weights were the number of animals per lot. Preliminary data analysis included frame score; however, it showed not to be statistically significant. Quadratic models and interactions were also evaluated in the preliminary analysis and

showed no statistical significance. A quadratic model could have been fit to the model; however with the restriction placed on weight (i.e., 250-386 kg) a linear model fit the data best. In the final analysis, all nonsignificant factors were removed as they could have inflated other standard errors. The level of significance was set at $p<0.05$.

RESULTS AND DISCUSSION

Cattle prices in the state of Alabama from 2012-2016: The cattle prices in the state of Alabama from 2012-2016 are given in Fig. 1. The cattle market fluctuated from a low of \$2.64 kg^{-1} in 2012 to a high of \$4.62 kg^{-1} in 2014. The cattle price in 2015 averaged \$4.51 kg^{-1}, however in 2016 the cattle price dropped to an average of \$2.75 kg^{-1}. From 2015-2016 the cattle price fell by \$1.76 kg^{-1} while between the years 2012 and 2013 the cattle price increased by \$0.36 kg^{-1} (Fig. 1).

Cattle prices in the state of Alabama by sex and sale type: Cattle prices in the state of Alabama by sex and sale type are shown in Fig. 2 and 3. Heifers marketed via board sales sold for an average \$3.57 kg^{-1} while heifers marketed via. auctions, sold for an average price of \$3.31 kg^{-1}. A difference of \$0.26 kg^{-1} was observed between the heifers marketed in the two different types of sales. Steers marketed via. board sales sold for an average of \$3.78 kg^{-1} while those marketed at an auction only sold for an average of \$3.58 kg^{-1}. However, the difference between the sale types is \$0.20 kg^{-1} compared to the \$0.26 kg^{-1} experienced with the heifers. Bulls could not be compared as board sales do not allow bulls to be marketed. The average price for auction bulls was \$3.29 kg^{-1}. Steers consistently sold for more kg^{-1} than heifers in both board and auction sales. The difference between board steers and heifers was observed at \$0.21 kg^{-1}.

Cattle prices in the state of Alabama by muscle scores: MS significantly influenced cattle prices kg^{-1} ($p<0.05$) Fig. 4. As indicated earlier, MS were assigned numerical values of 1, 1 and 2, 2 and 3, respectively. The MS classification with the highest price kg^{-1} was mixed lots that consisted of MS of 1 and 2. Calves with a MS of 1 and 2 were sold for an average price of \$3.67 kg^{-1}. While cattle with a MS of 1 sold for \$0.08 less kg^{-1} at an average price of \$3.59 kg^{-1}. As the MS increased from 1 and 2 to 2, the average price per kg decreased by \$0.20 making calves with a MS of 2 \$3.47 kg^{-1}. Cattle that received a MS of 3 sold for an average price of \$3.30 kg^{-1}, the lowest price kg^{-1} observed for MS.

Estimates of regression coefficients: The price difference between the two different sale types with bulls was found to be \$0.28 kg^{-1} (Table 1). Excluding bulls was

Table 1: The estimates of regression coefficients between different sale types and sex in the state of Alabama from 2012-2016

Estimates of regression coefficients				
Parameters	Estimate	SE	t-values	Pr>|t|
Auction vs. board (with bulls)	-0.2796	0.0177	-15.74	<0.0001
Steer slope vs. heifer slope	-0.0001	0.0003	-0.46	0.6468
Bull slope vs. steer slope	-0.0022	0.0003	-6.22	<0.0001
Bull slope vs. heifer slope	-0.0023	0.0004	-5.75	<0.0001
Auction vs. board (without bulls)	-0.2282	0.0178	-12.75	<0.0001
Gender vs. type interaction	0.0650	0.0234	2.77	0.0058

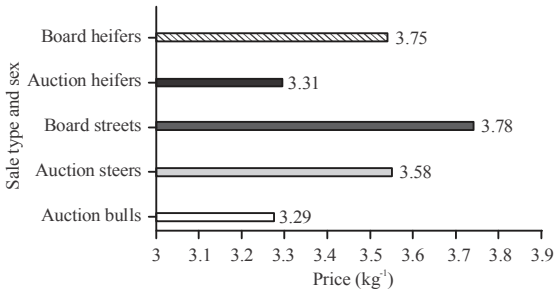

Fig. 2: Cattle prices in the state of Alabama from 2012-2016 by sex and sale type

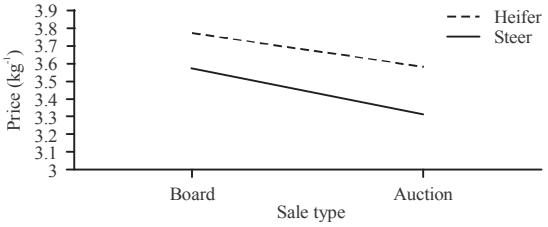

Fig. 3: The beef calves market prices in the state of Alabama based on sex and sale type and their interactions

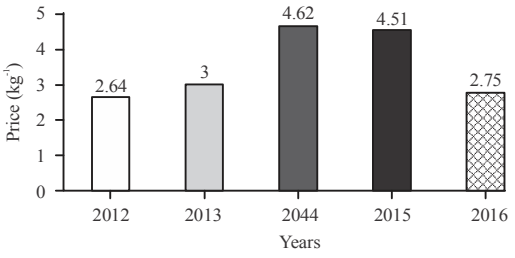

Fig. 1: Average cattle prices for each year from 2012-2016 in the state of Alabama

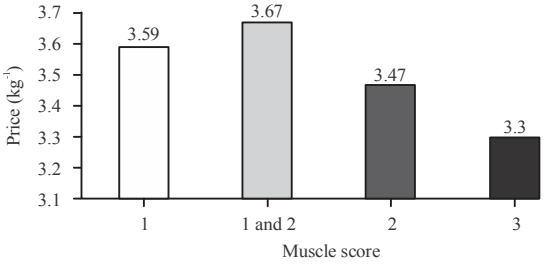

Fig. 4: Cattle prices in the state of Alabama from 2012-2016 by muscle score kg^{-1}

necessary as bulls did not appear in the two sale types. Without bulls the price difference between the two sale types was an average price difference of \$0.23 kg^{-1}. The steer and heifer slopes were not significantly different ($p>0.05$); however, the bull and steer slopes were significantly different ($p<0.05$) and the bull and heifer slopes were also significantly different ($p<0.05$). Heifers and steers were compared and found to have an average price difference of \$0.07 kg^{-1} regardless of sale type (Table 1).

Yearly cattle prices from 2012-2016: Cattle prices are always fluctuating as different Foreign and domestic factors influence them (Barham and Troxel (2007). The major international factors affecting cattle prices is trade (VanSickle, 1999). In this study, cattle prices were the highest in 2014 and the lowest in 2012. A similar cycle can be observed with cattle marketed through superior livestock auctions for the years, 1994-2001 (Avent *et al*., 2003). In 2015, the cattle prices dropped from \$4.62 to \$4.51 kg^{-1}. The cattle prices began to become more like those experienced at the start of the years analyzed at \$2.75 kg^{-1} which is \$0.11 kg^{-1} higher than 2012. The difference between the years 2013 and 2016 was an average of \$0.25 kg^{-1}. Furthermore, Henderson *et al*. found that cattle prices were higher than average in 2014 and have since, slowly declined. This is consistent as the data analyzed showed that the higher than average prices in 2014 which slowly declined to 2016 price. Anderson *et al*., identified a cycle that is constantly changing every 6-10 years where cattle prices will increase and decrease at a rate that was similar to what was in this 5 year analysis. The USDA-AMS of Iowa compiled a similar report for Iowa/Southern Minnesota, Sioux Falls, South Dakota and Oklahoma City, Oklahoma which reflected a similar pattern, however, the prices received in these Northern states were consistently much higher than those experienced in the Southeast. This can be explained by the location of the sales and the quality of the calves marketed. Furthermore, the prices received kg^{-1} were substantially higher in the midwestern part of the United States, it is apparent that the price received kg^{-1} follows a consistent pattern across the United States. This study also confirmed that the year 2014 received the highest beef cattle prices kg^{-1}. Brester (2015) also reported record high cattle prices in 2014 in the United States.

Yearly cattle prices could be influenced by the number of cattle marketed at a particular time of the year asthe cattle prices fluctuate significantly from season to season (Donnell *et al*., 2007; Seeger *et al*., 2011). Seeger *et al*. (2011) also stated that these seasonal price fluctuations are directly related to transitory phases in the beef production system and the highest beef prices are normally received June, 1 to July, 31 while the lowest prices are received in early marketing (May) or with late marketed calves in September and October. However, this does not align with Donnell *et al*. (2007), who claimed that calves marketed in mid-October to December received higher prices than those marketed at different times of the year.

Cattle prices by sex and sale type: There was a difference between board sales and auctions was significantly different with board sales consistently received higher prices compared to auctions. Board sales in the state of Alabama from the years, 2012-2016 saw an average price difference of \$0.23 more kg^{-1}. Heifers marketed through board sales sold at an average price of \$3.57 kg^{-1} which is \$0.26 kg^{-1} more than the auction. Producers may want to purchase heifers at board sales as replacement heifers as they are more likely to get better heifers than going to the auction. Auction steers sold for \$0.01 kg^{-1} more than board heifers. Steers marketed via board sales sold for an average price of \$3.78 which is \$0.20 kg^{-1} more than those sold via. auction. Avent *et al*. (2004) notes that previous research and data explains that historically lower prices overall are received for heifers and bulls as they do not perform as well in feed lots. Seeger *et al*. (2011) who also found that gender significantly effects the price received for a calf and found that steers consistently sold for \$8-10 more per head than heifers. Although, comparing our data to the data analyzed by Seeger *et al*. (2011), the price per head were significantly lower. When comparing bulls to heifers as the weight increased the price discount increased more rapidly for bulls than heifers (Barham and Troxel, 2007; Troxel and Barham, 2012). Additionally, Thrift and Thrift (2011) found that calves marketed and preconditioning sales received an average price of \$7.91 45.4 kg^{-1} which is approximately \$2.53 less 45.4 kg^{-1} than the average price observed in this study. This difference could possibly be due to the year and location that Thrift and Thrift (2011) analyzed.

Cattle prices by muscle scores: Muscle scores are assigned by trained graders and are an estimate of the quality of meat that will come from the animal.A muscle score of one signifies that the calf is highly marketable and will have a large ribeye area (Duggin and Stewart, 2013). Muscle scores significantly ($p<.001$) influence the price received by producers (Troxel *et al*., 2017). The results of this studyshowed an average price for calves that received MS1 at \$3.59 kg^{-1}. Barham and Troxel (2007) found calves with a MS1 to have an average price of \$2.65 ± 0.05 kg^{-1}. The highest average price was found for mixed lots of calves consisting of MS1 and 2. This can be explained by the number of head from each sale type with MS 1 and 2. Barham and Troxel (2007) found that calves with a MS 2 sold for an average price of \$2.45±0.09 kg^{-1} while the data analyzed in this

experiment had an average price of \$3.47 kg^{-1}. A decrease in average price kg^{-1} is observed in both the data analyzed and Barham *et al*. (2007); however, Barham and Troxel (2007) had a larger decrease from MS 1 and 2 than the data analyzed in this experiment. Calves with a MS 3 sold for approximately \$3.30 kg^{-1}, the lowest of all MS present in the data analyzed. Barham and Troxel (2007) found that calves with a MS 3 sold for an average price of \$2.12±0.44 kg^{-1}. The average price decrease that is experienced in both studies consistently decreases as the MS increases; however, Barham and Troxel (2007) did not group MS 1 and 2 together. Troxel *et al*. (2017) found that as MS increased from 1-2, 2-3, 3-4 there was \$8.94, \$32.41 and \$57.18 discount 45.4 kg^{-1}, respectively. Overall, the average prices between these studies are different and this can be explained by year, state of the cattle market, location of data collection and number head analyzed. Baggett *et al*. (2004) found that feeder calves with a MS 1 sold for \$54.53/head while feeder cattle with a MS 2 sold for \$45.06/ head. In this study, calves with a MS 1sold for less than those with a MS 1 and 2 combined. The difference could be attributed to the size and weight of the calves, most of the calves analyzed will spend time in a stocker/backgrounding as they are not large enough to go to the feedlot.

None of the studies found combined MS 1 and 2. This could be explained by the size and variety calves in the lots marketed in Alabama.

Estimates of regression coefficients: The current study, two values were received for the difference between auction and board sales. The first value received included bulls and provided a difference of \$0.28 kg^{-1}; however, bulls were removed from the analysis as they are not marketed through board sales. Once bulls were removed, the average price difference was \$0.23 kg^{-1}. The price differences between auction and board sales are extremely high compared to the \$0.07 kg^{-1} reported by Avent *et al*. (2004). Dhuyvetter *et al*. (2005) found a difference between the two marketing strategies \$14.16 per head. A 227 kg calf would be worth approximately \$52.21 more than a non-preconditioned calf in this study, however, there could have possibly been a similar net return from marketing preconditioned calves. The difference observed between these studies could possibly be explained by several factors such as the reputation of the protocol and the number of producers implementing it. Drovers (2016) recommended selecting a well-known preconditioning program as the name recognition influences the price received, many well-known programs come with affidavit to assure the purchasers that the protocol was followed.

The relationship of the slope for steers and heifers was evaluated and found to not be significantly different ($p>0.05$). As both, steers and heifers increase in weight, the price received kg^{-1} decreases at approximately the same rate; even though, there is a price difference between the two. Furthermore, the relationship between bull and steer slopes and bull and heifer slopes were significantly different, as the price kg^{-1} for bulls decreases more rapidly as the weight increases. The gender vs. type interaction provides the price difference between heifers and steers regardless of the sale type. The average price difference between the two was significantly different and observed at \$0.07 kg^{-1}.

CONCLUSION

The results from this study suggest that there is a potential for producers to increase their returns if they precondition their calves as there was \$0.23 difference kg^{-1} between the different marketing options. The cost of preconditioning was not considered in this study and future research should be conducted on the actual returns possible in the constantly fluctuating market.It is important to note, that there were several confounding factors that could not be taken into consideration in the study (e.g., reputation, hide color, season, lot uniformity and age of calf). The reputation of the producer can have a significant influence on the price he or she will receive kg^{-1}.

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REFERENCES

Anonymous, 2014. SAS-University Edition. SAS Institute Inc., Cary, North Carolina, USA.

Anonymous, 2017a. Alabama beef cattle facts. Alabama Cattlemen's Association, Montgomery, Alabama. https://www.bamabeef.org/p/about/alabama-beef-cattle-facts

Anonymous, 2017b. Beef industry statistics. National Cattlemen's Beef Association, Centennial, Colorado, USA.

Avent, R.K., C.E. Ward and D.L. Lalman, 2003. Economic value of preconditioning feeder calves. Oklahoma State University, Stillwater, Oklahoma. https://shareok.org/bitstream/handle/11244/49711/oksd_agec_583_2007-05.pdf?sequence=1

Avent, R.K., C.E. Ward and D.L. Lalman, 2004. Market valuation of preconditioning feeder calves. J. Agric. Appl. Econ., 36: 173-183.

Baggett IV, H.B., C.E. Ward and M.D. Childs, 2004. Effects of feeder cattle grades on performance and net return. J. ASFMRA., 67: 1-6.

Barham, B.L. and T.R. Troxel, 2007. Factors affecting the selling price of feeder cattle sold at Arkansas livestock auctions in 2005. J. Anim. Sci., 85: 3434-3441.

Brester, G., 2015. The US cattle cycle and calf prices. FSA Training Ag Marketing,Brewster, Massachusetts. http://animalrangeextension.montana.edu/beef/documents/2015Slides-Brester.pdf

Crozier, J. and K.A. Rood, 2012. Using preconditioning programs as a management tool for value added calves. Utah State University, Logan, Utah. https://pdfs.semanticscholar.org/ebd4/f2f85411d6be32364b0e3151105bb2f38648.pdf

Dhuyvetter, K.C., A.M. Bryant and D.A. Blasi, 2005. Case study: Preconditioning beef calves: Are expected premiums sufficient to justify the practice?. Prof. Anim. Sci., 21: 502-514.

Donnell, J., C. Ward and S. Swigert, 2007. Costs and benefits associated with preconditioning calves. Oklahoma State University, Stillwater, Oklahoma. http://agecon.okstate.edu/faculty/publications/2818.pdf

Drovers, 2016. Preconditioning options abound. Farm Journal, Inc., Philadelphia, Pennsylvania, USA. https://www.drovers.com/article/preconditioning-options-abound

Duggin, J. and L. Stewart, 2013. Feeder calf grading fundamentals. University of Georgia, Athens, Georgia. https://extension.uga.edu/publications/detail.html?number=B1481&title=Feeder%20Calf%20Grading%20Fundamentals

RSPCA., 2017. Why are cattle dehorned and is it painful?. RSPCA Australia, Deakin, Australia. https://kb.rspca.org.au/knowledge-base/why-are-cattle-dehorned-and-is-it-painful/

Raper, K.C., E.A. DeVuyst and D. Stein, 2011. Does preconditioning pay? A benefit-cost decision tool. Oklahoma State University, Stillwater, Oklahoma. http://pods.dasnr.okstate.edu/docushare/dsweb/Get/Document-7969/AEC-623.pdf

Seeger, J.T., M.E., King, D.M. Grotelueschen, G.M. Rogers and G.S. Stokka, 2011. Effect of management, marketing and certified health programs on the sale price of beef calves sold through a livestock video auction service from 1995 through 2009. J. Am. Vet. Med. Assoc., 239: 451-466.

Thrift, F.A. and T.A. Thrift, 2011. Update on preconditioning beef calves prior to sale by cow-calf producers. Prof. Anim. Sci., 27: 73-82.

Troxel, T., B. Barham, S. Cline, J. Foley, D. Hardgrave, R. Wiedower and W. Wiedower, 2017. Improving the value of feeder cattle. University of Arkansas, Fayetteville, Arkansas. https://www.uaex.edu/publications/PDF/FSA-3056.pdf

Troxel, T.R. and B.L. Barham, 2012. Phenotypic expression and management factors affecting the selling price of feeder cattle sold at Arkansas livestock auctions. Prof. Anim. Sci., 28: 64-72.

VanSickle, J.J., 1999. New factors affecting cattle prices. University of Florida, Gainesville, Florida. https://animal.ifas.ufl.edu/beef_extension/bcsc/1999/pdf/vansickle.pdf