Pakistan J. Zool., vol. 50(6), pp 2159-2163, 2018. **DOI**: http://dx.doi.org/10.17582/journal.pjz/2018.50.6.2159.2163

Influence of Different Weaning Ages on Growth Performance of Achai Crossed Jersey Calves

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Article Information
Received 10 April 2018
Revised 10 May 2018
Accepted 19 May 2018
Available online 19 September 2018

Authors' Contribution
TA, AHKK and AW designed and conceived the experiments. AHKK, AW, AI and MM performed the experiment. MI, NA and MFH analyzed the data. TA, AI and MNI wrote the manuscript.

Key words
Feed intake, Body weight gain, Feed efficiency, Milk replacer, Weaning age.

ABSTRACT

Early calf mortality (ECM) is one of the major constraints in livestock production system of Pakistan. Therefore, this study was designed to investigate the effect of different weaning ages on the growth performance of cattle calves to reduce ECM. Nine calves (Achai crossed Jersey) were randomly distributed into three weaning age groups *viz.,* A = 90, B = 70, and C = 110 days. In group A, calves were fed with whole milk at 10% of live body weight (LBW) for 4-7 days after initial colostrum feeding at 10% of LBW. From 8-30 days they received milk at 10% LBW + calf starter ration (CSR). During 31 to 63 days, milk at 10% LBW + CSR + green fodder (GF) was fed. Then, from 64-77 days they were fed milk at 5% LBW + CSR + GF. From 78-90 days milk at 2.5% LBW + CSR + GF. Calves in groups B and C were also fed with same feeding regimen with the corresponding age adjustments. The results showed that mean feed intake in weaning age groups-A, B and C was 5.71, 4.34 and 6.02 kg, respectively. Mean weight gain was 5.56, 5.02 and 6.70 (kg/15 days), respectively. Whereas, mean feed efficiency was 0.07, 0.13 and 0.09, respectively. Significant ($P > 0.05$) interaction was recorded for feed intake and feed efficiency between weaning age and feeding treatment. The economics of different weaning ages was also evaluated with maximum income from group-B (Rs. 71.1/day/calf). This study concluded that different weaning ages might contribute significantly to feed intake, body weight gain and feed efficiency of growing calves.

INTRODUCTION

In field conditions of Pakistan, there is high prevalence of early calf mortality. Reduction in early calf mortality is imperative to enhance productivity and to save the future stock. The definition of early weaning varies; generally, calves weaned before 150 days of age are considered early-weaned. Most research on early weaning has focused on late winter-early spring calving with little research evaluating early weaning outcomes on late spring-born (May and June) calves and low body weight gain. Calves can be weaned at 60 to 100 days of age, in which more intense calf management is needed; this makes the practice unpractical for many producers. However, the work done by Waterman *et al*. (2006) explored that weaning towards the end of the breeding season, at 120 to 160 days, is more practical and can be beneficial in certain situations.

In Pakistan, one of the major constraints in livestock production systems are the early calf mortality and body weight gain, this is due to different reasons like inadequate supply of colostrum at adequate time and improper milk feeding and management, so nutritional deficiency appear in small calves which result adversely on weaning age of growing calves. In start the calves required high proteinaceous diet for its growth and body weight gain, which could be achieved by providing colostrum feeding for continuously 24 h and plus milk feeding (Brown *et al*., 2005). Colostrum provides the calves antibodies and proteins (immunoglobulin). This makes the calves very defensive against many diseases and provides immunity to the calves. Calf needs colostrum up to 5% of its body weight within the first six hours of life, after that colostrum digestion level in the intestine is decreased. Moreover, rumen development in young calves depends upon the age and quality of feed that is provided from liquid and solid feed (Baldwin *et al*., 2004; Brown *et al*., 2005). The scientist have focused on emergent feeding strategies that facilitate early weaning and transitioning from liquid to solid feed. The effort is costly on improving the supply of milk or using alternate source of milk like milk replacer. One disadvantage of feeding whole milk is increasing the demand of milk by human population that

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0030-9923/2018/0006-2159 $ 9.00/0

cause reduce supply to young calves that eventually affect the performance of young calves and slower the rumen development (Diaz *et al*., 2001). Limited milk or milk replacer feeding to calves usually reduces their growth (Khan *et al*., 2007a), health and behavior (Huzzey *et al*., 2005) due to poor nutrients supply (Khan *et al*., 2007b). However, *ad libitum* feeding of liquid feed to calves delays the beginning of ruminal fermentation and development (Baldwin *et al*., 2004), this might be because of decreased solid feed intake (Jensen, 2006).

One of the goals of modern dairy farming is to identify nutritional strategies that enhance calf performance during early life, and subsequently improve mature production parameters, may provide unique opportunities to optimize feed resources and increase the profitability of beef cattle operations. If we reviewed the literature, different scientists reported that the daily direct suckling time and frequency reduced the calf age and ultimately stop at 6 months of age. In this context, the work of Iqbal *et al*. (2014) concluded that the indigenous calve reared with dam have a long term better performance and persistence and better for selection as replacement heifer.

Achai cattle, due to their small body size, are harbored in different mountainous areas of Khyber Pakhtunkhwa province. In our recently performed experiments (Khattak *et al*., 2018), we found 15.75 kg, 43.56 kg and 0.331 kg/d of average birth weight, average weaning weight, and average weight gains, respectively, in Achai crossed Jersey calves when fed with milk replacer at 10% LBW. This study further concluded that Achai calves performed better on milk replacer as compared to Azakheli buffalo calves. However, published data emphasizing the different weaning age effects in these cattle is scarce. Thus, the present study was designed to determine: (1) the effect of different weaning ages (early vs. normal) on feed intake of growing calves, (2) to evaluate the effect of weaning ages on body weight gain, (3) to study the effect of weaning age on feed efficiency in growing calves, and (3) to calculate the economics of experimental treatments.

MATERIALS AND METHODS

Location of study

The current study was designed and approved by the technical committee of Department of Animal Nutrition, University of Agriculture Peshawar, and was conducted at Government Livestock Research and Development Station, Surezai Peshawar, Khyber Pakhtunkhwa province of Pakistan.

Experimental design and animals

Prior to the commencement of this study, premises of the experimentation area and other gears used in the experiment were properly disinfected. A total of nine cattle calves (Achai crossed Jersy) were distributed into three weaning age groups *viz.,* 90 days, 70 days and 110 days, and each were with three replicates.

Experimental weaning ages

Weaning age of 90 days (control)

Weaning age of 90 days was taken as control. In this group, calves received milk at 10% live body weight (LBW) for 4-7 days after initial colostrum feeding at 10% LBW for the initial three days. From 8-30 days they obtained milk at 10% LBW + calf starter ration (CSR). During 31-63 days, milk at 10% LBW + CSR + hay/green fodder (HGF) was fed. Then, from 64-77 days they were fed milk at 5% LBW + CSR + HGF. From 78-90 days calves were offered milk at 2.5% LBW + CSR + HGF.

Weaning age of 70 days

The calves in this group were weaned at the age of 70 days after birth (early weaning). In this group the calves received colostrum at 10% LBW for three days, then milk was fed at 10% LBW for 4 days, then milk feeding at 10% LBW + CSR for 23 days, milk feeding at 10% LBW + CSR + hay for 20 days, milk feeding at 5% LBW + CSR + hay for 10 days, and finally milk was fed for the next 10 days at 2.5% LBW + CSR + HGF.

Weaning age of 110 days

The calves in this group were weaned at 110 days after birth (late weaning). In this group calves received colostrum at 10% LBW for three days, then milk was fed at 10% LBW for 4 days, then milk feeding at 10% LBW + CSR for 23 days, after then milk feeding reduced to 5% LBW + CSR + HGF for 40 days, then milk feeding at 2.5% LBW + CSR + HGF for 20 days, and finally milk at 2.5% LBW + CSR + HGF for next 20 days.

Parameters

Feed intake

Feed intake was calculated from the animals in each weaning age groups on daily basis, this was calculated from the difference between the amount of feed offered and refused feed. Using the below formula:

$$\text{Feed intake} = \text{Feed offered} - \text{Feed refusal}$$

Body weight gain

Body weight gain of the experimental animals was estimated after every 15 days using the following formula:

$$\text{Body weight gain} = \frac{\text{Final weight} - \text{initial weight}}{\text{Age in days}}$$

Feed efficiency

The feed efficiency of all animals in each weaning age group was calculated as gain in body weight per feed intake. The formula to calculate feed efficiency was:

$$\text{Feed efficiency} = \frac{\text{Gain in body weight (kg)}}{\text{Feed intake (kg)}}$$

Evaluation of economics

Economics of the whole trial was evaluated from cost of feed offered to experimental animals into relation to gain in body weight and sale of produced meat.

Statistical analysis

The data was statistically analyzed in split plot completely randomized design (CRD) using SPSS statistical analysis program (SPSS 16.0 software). Means values were compared with Duncan's multiple range tests.

RESULTS

Feed intake

Mean values of feed intake (kg/day/animal) at different weaning age are shown in Table I. Feed intake per animal among different treatments was significantly varied ($P < 0.05$). Feed intake by growing calves at different weaning age groups ranged from 4.34 kg to 6.02 kg per day. Mean feed intake at different weaning age groups *viz.,* 90, 70 and 110 days was 5.71±0.23 kg, 4.34±0.26 kg and 6.02±0.2 kg, respectively. Furthermore, there was significant interaction ($P < 0.05$) among the factors showing there was combined effect of weaning age and feed offered to experimental animals on feed intake (Table I).

Table I.- Effect of different weaning ages on feed intake (kg), body weight gain (kg/15 days) and feed efficiency (kg) of growing calves.

Weaning age (days)	Feed intake	Body weight gain	Feed efficiency
90 (control)	5.71^{ab}±0.23	5.56^{bc}±0.08	0.07^{c}±0.01
70	4.34^{c}±0.26*	5.02^{c}± 0.09*	0.13^{a}± 0.03
110	6.02^{a}±0.21	6.70^{a}±0.08	0.09^{bc}±0.02

Values (Mean±SEM) within same column with different superscripts are significantly different at $\alpha = 0.05$. *, highly significant at $p<0.001$.

Body weight gain and feed efficiency

Mean values of gain in body weight (kg/15 day) per animal at different weaning age groups are presented in Table I. Weight gain in animals among different weaning age groups was significantly different ($P < 0.05$). Weight gain in experimental animals across different weaning age groups ranged from 5.02 to 6.70 (kg/animal). Mean weight gain in animals at different weaning age groups *viz.,* 90, 70 and 110 days was 5.56 ± 0.08, 5.02 ± 0.09 and 6.70± 0.08 (kg/15 days), respectively. Comparison of weight gain among different weaning age groups showed that it was highest at weaning age group of 110 days, followed by weaning age group of 90 days. However, there was no significant interaction among the factors (weaning age group and feeding treatment) as shown in Table I.

Evaluation of economics

The economics of different weaning age groups was evaluated in term of weight gain (kg of meat sale in Rupees), which is depicted in Table II. Net income in Rupees (Rs.) from the sale of meat produced from animals at different weaning age groups is ranged from Rs. 794 to 6040. Comparison of net income from animals at different weaning age groups showed that it was maximum (Rs. 71.1/day/calf) at weaning age group of 70 days, followed by animals at weaning age group of 110 days (Rs. 54.9/ day/calf) and it was minimum (Rs. 8.8/day/calf) at weaning age group of 90 days (Table II).

Table II.- Evaluation of economics (Rupees) in term of weight gain in relation to different weaning age of growing calves.

Weaning age (days)	Cost of feed (Rs.)	Income from meat sale (Rs.)	Net income (Rs.)	Net income/ day/calf (Rs.)
90 (control)	47656	48450	794/90 days	8.8
70	30029	35010	4981/70 days	71.1
110	51850	57890	6040/110 days	54.9

DISCUSSION

In the current study the effects of different weaning age groups of growing calves on feed intake, weight gain, feed efficiency and economics were evaluated. Here, we noted higher feed intake in growing calves at weaning age of 110 days as compared to early weaning age group. The results of this study were in accordance with work of Kocyigi *et al.* (2013), who also reported higher feed intake at post weaning stage. These results are also supported by the study of Ogundola (1981), who reported higher feed intake at late weaning age (seven weeks) as compared to early weaning age. Apparently, the increased feed intake with this group is mainly due to longer feeding time period (110 days) and, secondly more development of rumen as compared to weaning age groups of 70 and 90 days. An important factor for considering is amount of

feed consumed by an animal in a certain period of time. Feeding calves milk at 10 % of body weight results in early consumption of starter and consequently it provides early rumen development of calves (Blum and Baumrucker, 2002). The micro-flora needs longer time to establish in the rumen of the calves fed whole milk as compared to calves fed on calf starter ration. However, the studies of several researchers (Azim *et al*., 2010; Khan *et al*., 2007a; Ozkaya and Toker, 2012) were also in contrast with our results, which reported that early weaned calves showed more feed consumption as compared to late weaned calves.

In our study, greater body weight gain was observed in calves weaned at the age of 110 days as compared to calves weaned at the age of 90 and 70 days. Obviously calves in this group were fed more and, therefore, higher gain in body weight was reported. Weight gain of calves may be greater due to consumption of larger amount of milk and starter ration which also increased digestion capacity and absorption of nutrients and subsequently affects the growth of calves (Blum and Baumrucker, 2002; Kišac, *et al*., 2011). Our results were similar with other studies (Kišac *et al*., 2011; Miller-Cushon *et al*., 2013; Yavuz *et al*., 2015), they reported that calves provided with milk for longer time and weaned lately showed higher body weight. Expectedly, higher feed efficiency of growing calves at weaning age of 70 days has been recorded as compared to other weaning age calves. Strikingly, calves placed in this group presented better feed efficiency with respect to less feed intake but more gain in body weight as compared with other two weaning groups. This might be due to better utilization of nutrients during early age (Haley *et al*., 2005). However, in contrast to present results on feed efficiency, Iqbal and Iqbal (1992) reported same FCR values (2.17) in buffalo calves fed on milk at 10% of body weight and calf starter along with green fodder and Khan *et al*. (2007a) reported higher FCR values in Holstein calves. This may be due to breed difference or climatic variations.

Cost of total feed consumed by the calves reared in weaning age group of 70 days was lower than weaning age group of 90 and 110 days. Moreover, income generated from meat produced from calves reared in weaning age group of 70 days was greater (Rs. 35010/-) than weaning age group 90 and 110 days (Rs. 48450/-) and (Rs. 57890/-), because due to less time they gain more weight respectively. Therefore, the net profit generated from meat production from animals reared in weaning age group of 70 days was maximum (Rs. 71.1/-).

CONCLUSION

The feed intake in weaning age group of 110 days was significantly higher in growing calves as compared to other weaning age groups. However, feed efficiency and net income of growing calves with weaning age group of 70 days was higher as compared to other weaning age groups; thus, weaning growing calves at the age of 70 days is recommended. Thus, this study concluded that variations in feed intake, body weight gain and feed efficiency of growing calves were attributed to different weaning ages.

ACKNOWLEDGEMENTS

This study was conducted with the financial support of ADP scheme of Government of Khyber Pakhtunkhwa through Directorate of Livestock Research and Development Khyber Pakhtunkhwa Peshawar. The project was titled as “Study on the causes of calf mortality and measures to reduce losses in Khyber Pakhtunkhwa”.

Statement of conflict of interest

Authors have declared no conflict of interest.

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