# Effects of an Intensive Feeding Program for Holstein Bull Calves From 1 Week to 12 Weeks of Age on Pre- and Immediate Post-weaning Growth and Subsequent Overall Feedlot Performance and Carcass Characteristics

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## Summary

Forty-eight week-old Holstein bull calves (95 lb) were used for a 14-month study to determine the effects of two milk replacer (MR) and calf starter feeding programs on pre- and immediate post-weaning calf growth, subsequent feedlot performance and carcass traits. Calves were randomly assigned to two dietary treatment groups; a) Control (C) - 22% CP:20% fat MR fed up to 1.25 lb/calf daily with an 18% CP calf starter; b) Intensive (INT) - 28% CP:20% fat MR fed up to 2.5 lb/calf daily with a 22% CP calf starter. Calves were fed MR in two equal feedings to 42 days of age and one-half of the above rate once daily from day 43 to weaning at 49 days. Calves were full-fed their respective calf starters until 12 weeks of age. From 12 to 20 weeks of age all calves were offered the 18% CP calf starter. Calves were individually housed in a calf room until 63 days of age then moved to 4 replicate group pens of 6 calves/pen within each treatment group. When body weights averaged 500 lb, steer groups were transitioned to a common whole corn (WC) and pellet (P) diet mixed with 1 lb chopped hay/head daily. At a pen body weight average of 700 lb, steer groups were fed WCP plus 1.5 lb hay until attaining a pen average market body weight goal of at least 1350 lb. Implants were administered at 6 to 8 weeks (Ralgro), 4 to 5 months (Ralgro), 7 to 8 months (Synovex-S), and 90 to 100 days (Synovex-S) prior to market. At weaning, calves fed INT had 16.9% > BW, 43.4% > gain, 22.9% > feed efficiency, 4.2% > hip height, 5.1% > chest circumference, and 7% > body length vs. those fed C diets ($P < 0.01$). Performance differences were negated during the growing–finishing periods. There were no differences in skeletal measurements by market weight. There were no differences in carcass characteristics ($P > 0.1$). Carcasses from C steers graded 65.2% Choice and 30.4% Select, and those from INT steers graded 73.9% Choice and 17.4% Select. Results clearly demonstrated the early calf growth advantages of the INT vs. C program. The loss of gain advantage for INT vs. control during the group-feeding phase was unexpected. Steer growth from day 1 to market weight was at the high range of predictions from previous studies with similar growing-finishing regimens.

## Introduction

Nutrient requirements and feeding programs for optimum growth of young dairy calves to be used as heifer replacements or dairy-beef steers has received a great deal of recent attention across the country. Research studies have indicated that conventional calf feeding programs have often compromised the genetic growth potential of young dairy calves especially during the pre-weaning period (Drackley, 2000). The first 2 months is the most efficient period to optimize the rapid growth potential of young calves. Studies with Holstein bull calves on high energy nutritional programs from weaning to market weight have shown that performance advantages during the first 2 to 3 months on feed will continue throughout the growing and finishing periods

(Chester-Jones et al., 1990; Chester-Jones et al., 1998). Commercial adaptation of an intensive management program developed at Cornell University by M.E. Van Amburgh and others (Diaz et al., 1998) feeding higher protein milk replacers, but with the similar fat levels as conventional milk replacers, have shown dramatic early growth responses (CowsMatch®; Land O'Lakes – http://www.cowsmatch.com). Whole corn:pellet growing and finishing programs for long-fed Holsteins have been shown to maintain good growth response and economic efficiencies (Traxler et al., 1995; Chester-Jones et al., 1996). The objectives of this study were to determine the effects of conventional vs. intensive milk replacer and calf starter feeding programs on overall performance and carcass traits of Holstein steers when fed high energy growing and finishing diets.

**Materials and Methods**

The study was conducted at the University of Minnesota Southern Research and Outreach Center (SROC) in Waseca, MN. A total of 54 Holstein bull calves were purchased by SROC from the Zumbrota Livestock Auction in Zumbrota, MN. Calves average 92 lb (range 80 to 110 lb). The study was approved by the University of Minnesota Institutional Animal Care and Use Compliance (IACUC) - Project Code Number: 0109A08701. Upon arrival at SROC, calves were weighed and placed within an inside calf room with 48 raised stalls and 6 calves in individual outside hutches. All calves were randomly assigned by initial body weight and serum protein concentrations to one of two dietary treatments with 24 calves per treatment in assigned raised stalls and 3 extra calves per treatment in outside hutches. Calf treatments are outlined below:

| Treatment | Milk replacer, % protein:fat | Milk replacer feeding rate[a], lb/calf/day | Calf starter protein level[b], % |
|---|---|---|---|
| Control | 22:20 | 1.25 | 18 |
| Intensive[c] | 28:20 | 2.50 | 22 |

[a] Milk replacer was fed 2X daily to 42 days of age and at one-half the above rates 1X daily from day 43 to 49.

[b] Calf starter protein levels fed until calves are 12 weeks of age. From 12 to approximately 20 weeks of age, both groups received the 18% protein starter.

[c] Intensive program: Cow Match® developed by Land O'Lakes.

Calves were individually fed for the first 63 days of the study. Calves were castrated, de-horned and implanted during the individual feeding phase. Calves were then moved to randomly assigned group pens by treatment based on the individual-feeding period-end weight. Steers were assigned to 4 replicate group pens per treatment (6 steers/pen). Group pens were in a pole barn with 20 inside manure pack pens and concrete feed bunks. Pen dimensions were approximately 14 ft x 30 ft with 10 ft feed bunks and individual Nelson waterers. Calves remained on their respective starter diets for 84 days then all calves were offered the 18% crude protein (CP) from 12 to approximately 20 weeks of age. When average group pen weights reached 500 lb steers, both treatment groups were transitioned to a full-feeding of a common diet of whole corn plus a supplement in a 2 phase program with dietary CP levels of 14.5% from 500 to 700 lb and 11.5% from 700 lb to market weight.

Steers received 1 lb/head of chopped medium to low quality hay daily to 700 lb. Long hay (1.5 lb) was fed from 700 lb to market weight. Hay was always fed first in the bunk with the whole corn and pellet mix added on top. During the period from 500 to 700 lb, steers were fed a grower pellet (38% CP) mixed at 320 lb/ton with whole corn at 1680 lb/ton. The complete mix supplied 26 g/ton of lasalocid or 13 mg/lb. From 700 lb to market, steers were fed a finisher pellet (30% CP) mixed at 200 lb/ton with whole corn at 1800 lb/ton. The complete mix was formulated to provide monensin sodium at 12.5 mg/lb and tylan at 4.5 mg/lb daily. Feed bunks were checked daily and bunk scored to ensure that all steer pens were on continuous full-feed with feed available 24 hours/day. Scoring was 0 = empty bunk; 1 = < 5 lb refusals; 2 = 5 to 10 lb refusal; 3 = 10 to 15 lb refusal; 4 = > 15 lb refusal. Steers were marketed when pen group means were approximately 1350 lb (average of two consecutive weights taken prior to feeding) and carcass data was collected at IBP, Dakota City, SD.

***Implant sequence*:** Ralgro (6 to 8 weeks of age) – Ralgro (4 to 5 months) – Synovex-S (7 to 8 months) – Synovex-S (90 to 100 days before market). Options for implant strategies are numerous with potential to refine programs more precisely based on marketing date and nutritional program offered (Chester-Jones, 2002). The implant sequence selection was a more traditional moderate option rather than an aggressive program.

***Animal weights:*** Initial weight upon arrival at SROC; 14, 28, 49, 63 and every 2 weeks up to approximately 20 weeks of age (pen average weights of 500 lb), every 28 days during feedlot phase (including a weight at weaning and when steers are moved to group pens); final weight was the average of 2 consecutive weights when cattle were ready for market.

***Feed consumption:*** Recorded on a daily basis (or whenever feed is fed or added to feed bunks) and weigh backs taken as necessary.

***Carcass traits:*** Included hot carcass weight, rib-eye area, back fat depth, internal kidney, pelvic and heart fat (kph), marbling score, yield grade, quality grade and dressing percent (hot carcass wt./live weight.

***Feed and ingredient sampling:*** Milk replacers, starters, corn, supplements, and hay were sampled during the study. Weekly composites of milk replacers were sub-sampled. One sample was sent CRF Project Supervisor, Roy Hall. A second sample was frozen with all other feed ingredient samples for future analyses. Minimum analysis to include at least crude protein, calcium phosphorus and dry matter concentration**.**

***Health and death loss records:*** Kept on an individual steer basis. Treatments, dates and products used were recorded. When a death loss occurred, dates and cause(s), if known were noted as well as the animal weight. Fecal scores were taken daily during phase 1 (1 = normal 4 + very watery).

***Blood samples:*** Blood samples were taken from all calves within 12 hours of arrival. Samples were split into 2 aliquots, one for serum protein analyses using a refractometer and the other frozen for subsequent serum IgG concentration.

**Results and Discussion**

The results reported will include all performance and carcass data collected. A total of 46 steers were marketed of the 48 assigned to the study.

***Individual feeding phase:*** During the initial 2 weeks of the study, calves had health challenges and the majority exhibited diarrhea. Serum protein levels of < 4 g/l indicated poor passive immunity transfer and the health challenges were expected as a result. This was expressed by a variable response to intake of milk replacer for both the conventional and intensively fed calves. Cryptospiridia and rota-corona viruses were the predominant organisms identified. Within 9 days after arrival at SROC, 4 calves were lost and replaced by extra calves assigned to the respective treatment groups. On day 22 after arrival, a fifth calf was lost due to anaphylactic shock to a vaccine.

Calves were fed milk twice daily beginning at 7:30 AM and approximately 4:00 PM. Care was taken to allow calves to adjust slowly to the increasing liquid volume of the intensive program. Total milk DM offered for the first 14 days for Control (C) calves was 17.5 lb and 29.2 lb for the Intensive (INT) calves. Actual total milk DM intake after refusals was 15.3 and 24.3 lb for C vs. INT fed calves, respectively. From days 15 to 28, INT calves were offered 2.5 lb Milk DM daily for a total of 35 lb DM. Actual milk DM intake averaged 16.9 vs. 33.7 lb for C vs. INT fed calves, respectively. The distribution percentage relationship between milk offered and refused by number of calves from day 1 to day 28 is summarized in Table 1. The top two rows indicate the amount milk DM offered and actual average intake by treatment. The remaining rows indicate the milk DM intake range by treatment group.

A complete calf performance summary for the individual feeding phase 1 is shown in Table 2. In the first 14 days, C calves consumed more calf starter, less milk DM and total DM than INT calves. The differences in total DM intake (DMI) resulted in average daily gains (ADG) from day 1 to 14 of 0.24 and 0.96 lb (+ 393% vs. C) for C and INT calves, respectively. The INT calves gained 0.51 lb for each lb of DMI (gain/feed, G/F) vs. 0.18 lb for each lb of DMI for C calves, a 283% response in improved feed efficiency for the former. A similar pattern continued for days 15 to 28. The differential in total DMI between C and INT calves was reduced from 41.2 to 32.8% in this second 14 days period. Daily gain and G/F for days 1 to 28 averaged 0.65, 0.37; 1.39 (+214%) and 0.59 (+160%) lb for C and INT calves, respectively. Calves fed C diets continued to consume more calf starter DM but less total DM than those fed INT diet from day 29 to weaning at 49 days. Total calf starter DM and milk DM for days 1 to 49 was 86.7, 53.9; 42.1 and 101.3 lb for C and INT fed calves, respectively. During this pre-weaning period, calves fed the INT diet had 16.1% higher total DMI, a 43.4% greater ADG and 22.9% improved feed efficiency vs. those fed C diets (Table 2). During the intensive program development by Land O'Lakes (LOL; http://www.cowsmatch.com) over 2000 calves were used to evaluate similar conventional (C) vs. Intensive (INT) programs. In these studies, the calves fed C diets consumed 51.2 lb milk DM, 48.1 lb calf starter DM, gained 40.4 lb, (ADG of 0.83 lb) with a G/F of 0.41 lb. Calves fed INT diets consumed 107.6 lb milk DM, 27.9 lb calf starter DM, gained 74.4 lb (ADG of 1.52) with a G/F of 0.55 lb. In comparison, under the conditions of the SROC study both the C and INT calves had greater starter intakes, weight gains and better feed conversions.

In the 14-day post-weaning period in phase 1, SROC study calves fed C calf starter gained 32.7 lb, ADG of 2.34 lb and G/F of 0.44 lb. Calves fed INT calf starter gained 32.2 lb ADG of 2.30 lb and G/F of 0.44 lb. The overall phase 1 calf performance from days 1 to 63 for C calves averaged an ADG of 1.45 lb and G/F of 0.46 lb. Calves fed INT diets had a ADG of 1.84 lb (+ 26.9% vs. C) and G/F of 0.54 lb (+17.4% vs. C). Total weight gain advantage over 63 days was 25.5 lb. A summary of the fecal scores taken during phase 1 are shown in Table 3. From days 15 to 63, calves assigned to the INT diets had consistently higher fecal scores. Although differences were significant, fecal scores were within a score of 1 to 2 which indicates a softer

than normal stool which might be expected from the nutritional feeding strategy differences between C and INT fed calves.

Skeletal measurements taken on day 1 and at weaning on day 49 clearly showed the growth advantages in calves fed the INT diets (Table 2). Calves fed the C diets gained 5.9 cm in hip height, 13.5 cm in chest circumference, and 1.5 cm in body length. Calves fed INT diets gained 8.6 cm in hip height (+ 45.8% vs. C), 18.2 cm in chest circumference (+34.8% vs. C) and 4.2 cm in body length (+280% vs. C). In a group of co-mingled bull calves it was very apparent that there were a number of phenotypic differences in calf conformation due to genetics. This should have been relatively the same across the treatment groups.

Calves were transferred from individual stalls to assigned replicated group pens by weight to heavy, medium and light groups to reduce the within pen variation for intake and social behavior patterns. Calves adjusted well to their new environment. Phase 2 group feeding performance summary is shown in Table 4. After phase 1, a calf was removed from the study due to chronic health problems. Later in the feedlot phase a 550 lb steer was lost due to excessive bloat caused by a herniated diaphragm.

Table 1. Percentage distribution of actual milk DM intake by calves for days 1 to 28.

| Range of milk DM, lb | Control, days 1 to 14 | Intensive, days 1 to 14 | Control, days 15 to 28 | Intensive, days 15 to 28 |
|---|---|---|---|---|
| Milk DM offered by period, lb | 17.5 | 29.0 | 17.5 | 35.0 |
| Milk DM intake by period, lb | 15.3 | 24.3 | 16.9 | 33.7 |
| ---------- | % of calves | % of calves | % of calves | % of calves |
| 10 to 11 | 16.7 | --- | --- | --- |
| 12 to 13 | 12.5 | 4.4 | 8.3 | --- |
| 14 to 15 | 20.8 | --- | 4.2 | --- |
| 16 to < 17 | 8.3 | 4.4 | 4.2 | --- |
| 17 to < 18 | 41.7 | 8.7 | 83.3 | --- |
| 18 to 19 | --- | 4.4 | --- | --- |
| 20 to 21 | --- | 13.0 | --- | --- |
| 22 to 23 | --- | 4.4 | --- | --- |
| 24 to 25 | --- | 13.0 | --- | 4.4 |
| 26 to 27 | --- | 4.4 | --- | 4.4 |
| 28 to 29.2 | --- | 39.1 | --- | 4.4 |
| 30 to 31 | --- | --- | --- | --- |
| 32 to 33 | --- | --- | --- | 8.6 |
| 34 to 35 | --- | --- | --- | 78.2 |

Table 2. Phase 1 - Days 1 to 63 calf performance in individual stalls; control (C) vs. intensive (INT), least squares means.

| Parameter | C | INT | SE | C vs. INT | P value |
|---|---|---|---|---|---|
| **Days 1 to 14** | | | | | |
| Initial BW, lb | 94.8 | 95.3 | 1.5 | --- | NS |
| Serum protein, g/l | 3.88 | 3.77 | 0.34 | --- | NS |
| Initial HH[a], cm | 82.2 | 83.2 | 0.58 | --- | NS |
| Initial CC[a], cm | 79.3 | 79.3 | 0.63 | --- | NS |
| Initial LB[a], cm | 40.0 | 40.2 | 0.55 | --- | NS |
| Milk DM, lb | 15.26 | 24.31 | 0.69 | –59.3% | P < 0.01 |
| Feed DM, lb | 3.34 | 1.95 | 0.56 | +71.3% | P < 0.07 |
| Total DM, lb | 18.60 | 26.26 | 0.81 | –41.2% | P < 0.01 |
| BW d-14,lb | 98.1 | 108.7 | 1.25 | –10.8% | P < 0.01 |
| **Days 15 to 28** | | | | | |
| Milk DM, lb | 16.93 | 33.70 | 0.52 | –99.1% | P < 0.01 |
| Feed DM, lb | 13.20 | 6.32 | 0.83 | +208.9% | P < 0.01 |
| Total DM, lb | 30.13 | 40.02 | 0.81 | –32.8% | P < 0.01 |
| BW d-28, lb | 112.9 | 134.2 | 1.35 | –18.9% | P < 0.01 |
| **Days 29 to 49** | | | | | |
| BW d-49, lb | 153.5 | 179.5 | 1.61 | –16.9% | P < 0.01 |
| HH d-49, cm | 88.1 | 91.8 | 0.58 | –4.2% | P < 0.01 |
| CC d-49, cm | 92.8 | 97.5 | 0.70 | –5.1% | P < 0.01 |
| LB d-49, cm | 41.5 | 44.4 | 0.52 | –7.0% | P < 0.01 |
| Milk DM, lb | 21.7 | 43.3 | 0.37 | –99.5% | P < 0.01 |
| Feed DM, lb | 53.2 | 33.8 | 1.38 | +57.4% | P < 0.01 |
| Total DM, lb | 74.9 | 77.1 | 1.39 | –2.9% | NS (< 0.7) |
| **Days 1 to 49** | | | | | |
| Total DM, lb | **123.6** | **143.5** | **1.74** | –16.1% | P < 0.01 |
| Gain, lb | **58.7** | **84.2** | **2.10** | –43.4% | P < 0.01 |
| G/F, lb | **0.48** | **0.59** | **0.01** | –22.9% | P < 0.01 |
| **Day 50 to 63** | | | | | |
| BW d-63, lb | 186.2 | 211.7 | 1.65 | –13.7% | P < 0.01 |
| Feed DM, lb | 73.83 | 72.63 | 1.26 | +1.7% | NS (< 0.8) |
| **Day 1 to 63** | | | | | |
| Total DM, lb | **197.43** | **216.13** | **2.09** | –9.5% | P < 0.08 |
| Gain, lb | **91.40** | **116.4** | **1.92** | –27.0% | P < 0.01 |
| G/F, lb | **0.46** | **0.54** | **0.06** | –17.4% | P < 0.03 |

[a] HH = hip height; CC = body circumference behind front legs; LB = body length from top of withers to rear pin bones.

Table 3. Average fecal scores of calves by treatment and pre-weaning period[a].

| Days on feed | Control | Intensive | SE | Significance |
|---|---|---|---|---|
| 1 to 14 | 2.26 | 2.39 | 0.10 | NS (< 0.4) |
| 15 to 28 | 1.47 | 1.72 | 0.09 | P < 0.04 |
| 29 to 49 | 1.17 | 1.68 | 0.05 | P < 0.01 |
| 50 to 63 | 1.05 | 1.47 | 0.06 | P < 0.01 |

[a] Fecal scores based on a 1 to 4 scale (1 = normal; 4 = watery) taken daily prior to morning feeding.

Table 4. Phase 2 - group pen feedlot performance; control (C) vs. intensive (INT), least squares means.

| Parameter | C | INT | SE | C vs. INT | P value |
|---|---|---|---|---|---|
| **Days 64 to 159 (avg 500 lb)** | | | | | |
| BW d-63, lb | 186.2 | 211.7 | 1.65 | –13.7% | P < 0.01 |
| Actual DOF | 96 | 94 | 0.90 | +2.0% | NS (< 0.3) |
| Feed DM, lb | 930.05 | 923.43 | 9.70 | +.7% | NS (< 0.7) |
| BW d-159,lb | 500.0 | 506.2 | 1.53 | –1.2% | NS (< 0.2) |
| Gain, lb | 313.8 | 294.5 | 2.32 | +6.6% | P < 0.02 |
| G/F, lb | 0.34 | 0.32 | 0.005 | +6.3% | P < 0.07 |
| HH, cm | 111.5 | 114.2 | 0.29 | –2.4% | P < 0.03 |
| CC, cm | 137.5 | 137.6 | 0.07 | --- | NS (< 0.8) |
| LB, cm | 65.1 | 64.8 | 0.82 | --- | NS (< 0.9) |
| **Day 160 to 215 (avg 700 lb)** | | | | | |
| Actual DOF | 56 | 52 | 1.58 | +7.7% | NS (< 0.2) |
| Feed DM, lb | 885.82 | 824.05 | 21.08 | +7.5% | NS (< 0.2) |
| BW d-215,lb | 708.1 | 700.8 | 5.96 | +1% | NS (< 0.5) |
| Gain, lb | 208.1 | 194.6 | 5.88 | +6.9% | NS (< 0.3) |
| G/F, lb | 0.23 | 0.24 | 0.003 | –4.4% | NS (< 1.5) |
| **Day 215 to mkt BW, lb** | | | | | |
| Actual DOF | 211 | 210 | 5.61 | --- | NS (< 1.0) |
| Feed DM, lb | 4284.4 | 4399.6 | 75.65 | –2.7% | NS (< 0.4) |
| Final BW, lb | 1371.8 | 1374.8 | 9.27 | --- | NS (< 0.9) |
| Gain, lb | 663.7 | 674.0 | 8.95 | –1.6% | NS (0.6) |
| G/F. lb | 0.16 | 0.15 | 0.003 | --- | NS (< 0.7) |
| HH, final cm | 134.9 | 135.5 | 0.58 | –0.5% | NS (< 0.6) |
| CC, final cm | 201.8 | 202.4 | 0.42 | –0.3% | NS (< 0.5) |
| LB, final cm | 86.2 | 85.7 | 0.10 | +0.6% | NS (< 0.07) |

Group pens were switched to the common whole corn:pellet diet at an average pen weight of 500 lb for the C groups (range 85 to 108 days on feed) and 506 lb for the INT groups (range 80 to 108 days on feed). Steers in the C group had an ADG of 3.27 lb and G/F of 0.34 lb in this period. In contrast steers in the INT groups had lower ADG (3.13 lb) and G/F (0.32 lb). Consequently during this feedlot phase gain and skeletal advantages for INT calf groups from phase 1 were somewhat negated. This is substantiated by the cumulative performance from day 1 to the switch over to the whole corn:pellet program shown in Table 5. Average daily gains were 2.55, 3.15; 2.58 and 3.00 lb for days 1 to 159 and post-weaning to 159 days for C and INT steers respectively. Post-weaning gains to 23 weeks were similar to those predicted for whole corn:pellet diets (Chester-Jones et al., 1996; Chester-Jones et al., 1998). However, the average body weights were over 50 lb more than predicted for both steer groups. The cumulative performance summary for a similar period up to 23 weeks from other intensive studies with 2000 calves (http://www.cowsmatch.com/trials.html) indicated a 52.5 lb gain advantage to INT steer groups vs. C steers. Average body weights were 135.5 and 89 lb lower for C and INT, respectively, in these studies compared to the SROC study. Sampling size difference between a single study at SROC and multiple studies may have accounted for much of this.

Table 5. Cumulative feedlot and combined overall performance; control (C) vs. intensive (INT), least squares means.

| Parameter | C | INT | SE | C vs. INT | P value |
|---|---|---|---|---|---|
| **Days 1 to 159 (avg 500 lb)** | | | | | |
| BW d-63, lb | 186.2 | 211.7 | 1.65 | –13.7% | P < 0.01 |
| Cum DOF | 159 | 157 | 0.73 | --- | NS (< 0.2) |
| Cum DM, lb | 1127.5 | 1139.6 | 18.09 | –1.1% | NS (< 0.8) |
| Cum G, lb | 405.2 | 410.9 | 4.06 | –1.4% | NS (< 0.5) |
| Cum G/F, lb | 0.36 | 0.36 | 0.005 | --- | NS (< 0.8) |
| **Day 1 to 215 (avg 700 lb)** | | | | | |
| BW d-215, lb | 708.1 | 700.8 | 5.96 | +1% | NS (< 0.5) |
| Cum DOF | 215 | 209 | 1.90 | +2.9% | NS (< 0.2) |
| Cum DM, lb | 2013.3 | 1963.7 | 14.80 | +2.5% | NS (< 0.1) |
| Cum G, lb | 613.3 | 605.5 | 5.35 | +1.3% | NS (< 0.4) |
| Cum G/F, lb | 0.31 | 0.31 | 0.003 | --- | NS (< 0.7) |
| **Day 1 to mkt BW, lb** | | | | | |
| Final BW, lb | **1371.8** | **1374.8** | **9.27** | **–0.2%** | NS (< 0.9) |
| Cum DOF | **426** | **419** | **4.49** | **+1.7%** | NS (< 0.5) |
| Cum DM, lb | **6297.7** | **6363.3** | **120.3** | **–1%** | NS (< 0.9) |
| Cum G, lb | **1277** | **1279.5** | **17.29** | **–0.2%** | NS (< 1.0) |
| Cum G/F, lb | **0.20** | **0.20** | **0.003** | **---** | NS (< 2.0) |

In the final growing phase, C steers switched to finisher at an pen average of 708.1 lb (range of 54 to 62 days on feed) and the INT steers at 700.8 lb (range of 51 to 54 days on feed). There were no statistical differences in steer group performances. The C steer groups tended to maintain higher feed intakes and subsequent gains. These slight advantages were indicated in the cumulative performance for C steers from day 1 to the 700 lb switch to finisher diets (Table 5). In finishing phase INT steers gained at 3.21 lb/day with a 0.15 lb G/F. The C steers gained at

3.15 lb/day with a 0.16 G/F. Steers were maintained on their finishing diets until the group pen average weights were at least a 1350 lb market weight. Cumulative steer gain and G/F were very similar for the entire study across dietary groups (Table 5). One C steer pen group was sent to market 28 days after the other 7 pens which accounted for the 7 days less on feed for INT steers.

Carcass data is summarized in Table 6 below. The quality of carcasses was very acceptable. One steer in the C group and 2 in the INT group were designated as Dark Cutters.. Discount for these were between $150 and $200/head compared to the other carcasses. A total of 3 livers were condemned form the steers marketed. In the INT steer group, 8.7% more carcasses graded choice or above vs. the C group (65.2 vs. 73.9%). The steers in the INT group had a higher number of modest and moderately abundant marbled carcasses, which resulted in a 7.7% advantage in marbling score. There were no significant difference in carcass parameters. Average daily gains from day 1 to market were 3.00 and 3.05 lb for C and INT steers, respectively. Feed efficiencies were slightly better than predicted for long-fed Holsteins (Chester-Jones et al., 1998).

Table 6. Comparison of carcass parameters for control (C) vs. intensive (INT) steers.

| Parameter | Control (C) | Intensive (INT) | SE | P value | C vs. INT |
|---|---|---|---|---|---|
| Final BW, lb[a] | 1371.8 | 1374.8 | 2.85 | NS (P < 1.0) | |
| Hot carcass weight, lb | 812.9 | 809.6 | 2.35 | NS (P < 0.9) | |
| Dressing % | 59.2 | 58.9 | 0.04 | NS (P < 0.6) | |
| Rib eye area, sq in | 11.34 | 11.39 | 0.30 | NS (P < 0.9) | |
| Back fat, in | 0.43 | 0.46 | 0.10 | NS (P < 0.4) | –7.0% |
| KPH, % | 2.34 | 2.43 | 0.16 | NS (P < 0.2) | –3.9% |
| Marbling score[b] | 442 | 476 | 3.07 | NS (P < 0.3) | –7.7% |
| **Quality Grades** | | | | | |
| Choice or >, % | 65.2 | 73.9 | | | –13.3% |
| Select, % | 30.4 | 17.4 | | | +74.7% |
| Dark cutters, % | 4.4 (1) | 8.7 (2) | | | |
| **Marbling scores** | | | | | |
| Slight, % | 26.1 | 17.4 | | | +50.0% |
| Small, % | | | | | |
| Modest, % | 52.2 | 47.8 | | | +9.2% |
| Mod. abundant, % | 17.4 | 21.7 | | | –24.7% |
| | 4.3 | 13.1 | | | –304.7% |
| **Yield Grade** | 2.83 | 2.93 | | | 0.23 |
| | | | | | –3.5% |

[a] Average of two morning consecutive weights prior to feeding; the second weight taken on day of marketing.

[b] Marbling score of 300 = slight; 400 = small; 500=modest; 600 = moderately abundant.

## Conclusion

The results of this study reported here-in demonstrated the pre-weaning growth advantages of an intensive vs. conventional calf raising program. In this study these advantages were not maintained throughout the feeding period for long-fed Holstein steers. More balanced pre-weaning feeding schedules may have enhanced milk replacer intake and resulted a greater growth differential for the intensive programs. Feeding long hay appeared to help the consistency in feed intake during the growing-finishing periods. A more aggressive implant program may have enhanced steer performance. During the 14-month study all steers were subjected to environmental temperature changes equally across dietary groups. There were indications that carcass quality tended to improve overall from the intensive pre-weaning program. A complete economic analysis will define the cost:benefit ratios for each feeding regimen.

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