**Application** Increasing the plane of nutrition offered to bull calves during either the pre-weaning or early post-weaning phases of development resulted in higher weight gain respectively, with post-weaning differentials retained to slaughter at 16 months of age, affecting carcass weight, a key economic trait.

**Introduction** Only 38% of Irish dairy-bred bull beef carcasses meet the desired slaughter specifications, resulting in both economic and environmental inefficiencies (Kenny et al., 2020). Early-life nutrition can play a central role in determining lifetime growth potential and carcass composition. Strategic nutritional intervention during key developmental windows can positively influence carcass gain, adiposity, and meat quality. However, limited data exist on the immediate and long-term effects of such interventions on animal performance, carcass traits, and the production and environmental efficiency of pasture-based dairy bull-beef production systems. This study aimed to assess the impact of both pre- and post-weaning nutrition and their interaction, on performance and carcass composition in dairy-bred male calves slaughtered at 16 months of age.

**Materials and Methods** Spring-born dairy-bred Angus and Holstein Friesian bull calves (n=56), were blocked by breed, birth date and birth weight, and assigned within block to either a moderate (M PRE) or high (H PRE) pre-weaning plane of nutrition and allocated across four pens. Calves (7 days of age) assigned to M PRE were offered a typical rearing diet of 6L/day containing 750g milk replacer (MR; 26% protein and 16% fat) for 50 days followed by a 2-week weaning period. H PRE were offered 8L/day containing 1200g MR for 14 days, 10L/day containing 1500g MR for 24 days followed by a 3-week step-down weaning period. Both pre-weaning treatments had *ad libitum* access to concentrate feed. Post-weaning, from within their respective pre-weaning treatments, calves were allocated to either a moderate (M POST), 1.5kg/day concentrate, or high (H POST), *ad libitum* concentrate, post-weaning diet for four weeks. All calves were individually offered their respective dietary allocation of MR and pelleted concentrate (18% CP) via an electronic calf feeding system (Foster-Technik Vario; Engen, Germany). Subsequently, all animals were turned out to pasture and managed under a standard 16-month-old pasture based dairy bull beef system blueprint with bodyweight and other anatomical measurements collected throughout and carcass characteristics data collected at slaughter.

All data were analysed in SAS (v9.4) using ANOVA (MIXED procedure the model included fixed effects PRE and POST plane of nutrition, their interaction along with random effects of block and pen.

**Results** No interactions were observed between pre- and post-weaning diets for animal performance and carcass variables. An interaction between week and both pre and post-weaning dietary treatment was observed for both dry matter (DMI) and energy intake as per design. H PRE calves had greater ADG than M PRE pre-weaning resulting in higher bodyweight at weaning (+8.4kg, P = 0.0002), turnout (5.7kg, P = 0.024), housing (+11.3kg, P = 0.05), however, no effect (P >0.05) of pre-weaning diet was observed on bodyweight or carcass characteristics at slaughter (Table 1). As expected H POST had higher ADG post-weaning than M POST resulting in a bodyweight advantage at turnout (+19.3kg, P <0.0001), housing (+20.0kg, P = 0.001) and slaughter (+29.0kg, P = 0.001) with a 16kg difference in carcass cold weight (P = 0.001; Table 1). Weight gain during the grazing and finishing periods were similar across both dietary groups thus preserving the weight differentials established as a consequence of the early life nutritional treatments.

**Table 1** Effect of pre- and post-weaning plane of nutrition (M or H) on performance of dairy-bred bull calves slaughtered at 16 months of age

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Plane of nutrition** | **Pre-weaning** | |  | **Post-weaning** | |  |  | **Significance\*** | |
| **M PRE** | **H PRE** |  | **M POST** | **H POST** | **SEM** |  | **Pre-weaning** | **Post-weaning** |
| **Bodyweight (kg)** | | | | | | | | | |
| Birthweight | 35.3 | 36.9 |  | 36.4 | 35.9 | 1.07 |  | NS | - |
| Arrival (3 Weeks) | 46.8 | 52.0 |  | 49.9 | 48.9 | 1.20 |  | \*\* | - |
| Weaning (11 Weeks) | 83.7 | 92.0 |  | 87.9 | 87.8 | 1.70 |  | \*\* | - |
| Turnout (15 Weeks) | 108.8 | 114.5 |  | 102.0 | 121.3 | 2.00 |  | \* | \*\*\* |
| Housing (9 months) | 188.2 | 199.5 |  | 183.8 | 203.8 | 4.72 |  | \* | \*\* |
| Bodyweight at slaughter (16 months) | 522.0 | 531.3 |  | 512.0 | 541.2 | 9.27 |  | NS | \*\* |
| Carcass weight | 270.1 | 273.8 |  | 263.8 | 280.1 | 5.40 |  | NS | \*\* |
| Conformation | 5.4 | 4.9 |  | 5.0 | 5.4 | 0.32 |  | NS | NS |
| Fat score | 7.2 | 6.6 |  | 7.1 | 6.7 | 0.45 |  | NS | NS |
| **Average daily gain (kg)** | | | | | | | | | |
| Pre-weaning period (11 weeks) | 0.71 | 0.81 |  | - | - | 0.024 |  | \* | - |
| Post-weaning period (4 weeks) | 0.91 | 0.84 |  | 0.55 | 1.20 | 0.040 |  | NS | \*\*\* |
| Grazing period (5 months) | 0.57 | 0.61 |  | 0.59 | 0.59 | 0.030 |  | NS | NS |
| Housing to Slaughter (7 months) | 1.34 | 1.32 |  | 1.32 | 1.35 | 0.035 |  | NS | NS |

\*Non-significant (P>0.05) pre-weaning x post-weaning diet interaction was observed. \*, \*\* and \*\*\* indicate P < 0.05, < 0.01 and < 0.001, respectively

**Conclusions** Pre-weaningplane of nutrition had impacts on bodyweight only to 9 months, with no impact on carcass traits. However, **o**ffering dairy-bred male calves a high plane of nutrition for four weeks post-weaning, irrespective of pre-weaning plane of nutrition, led to enhanced bodyweight gain which was subsequently retained to slaughter at 16 months of age. This also translated to higher carcass weight at slaughter in these animals. There was no evidence of compensatory gain in animals offered a moderate pre-weaning plane of nutrition, followed by a high plane of nutrition post-weaning. These findings highlight the vital role of optimising post-weaning nutrition to enhance overall lifetime growth and feed efficiency. Research is needed to further refine post-weaning nutritional strategies and evaluate their impact on the economic and environmental efficiency of sustainable pasture-based dairy calf-to-beef production systems.

**References** Kenny, D., C. P. Murphy, R. D. Sleator, M. M. Judge, R. D. Evans, and D. P. Berry. 2020. Animal-level factors associated with the achievement of desirable specifications in Irish beef carcasses graded using the EUROP classification system. Journal of Animal Science 98(7) doi: 10.1093/jas/skaa191