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Comparison of Growth Characteristics of Holstein, Brown Swiss, and Their F_1 Crossbred during the Wintering Period

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Abstract: This experiment was conducted to compare growth characteristics of Holstein (n = 12), Brown Swiss (n = 10) and Holstein x Brown Swiss crossbred (n = 6) spring-born calves supplemented with grain during the wintering period. After ending the weaning period, animals were transferred to tie-stall barn and were subjected to three phases of wintering, each lasting 56 days. From beginning of 219 days of age, during 168-day experimental period (6 months), live weight was measured bi-monthly period. In addition to *ad libitum* hay, each animal was supplemented with 1, 1.25 and 1.50 kilogram barley per day during the respective experimental periods. Data were analyzed using the GLM procedure using initial body weight as a covariate. There was no breed effect on body weight, feed intake, average daily gain and feed conversion ratio. However, bull calves gained more body weight and consumed less amount of feed per kilogram body weight gained than heifer calves. There was no breed by sex interaction effect on growth performance variables. A lack of breed differences could be attributed to grain supplementation. Sex effect, though experiment conducted pre-puberty period, on growth performance was ambiguous. Results of this experiment suggest that regardless of animal breed, feeding post-weaned calves nutritionally balanced ration –grain supplementation– has merit to achieve optimum body weight for grazing season to reduce slaughter age and subsequent successful reproductive performance to be used as replacement heifers.

Key words: Growth performance, Breed, wintering, Grain supplementation

Introduction

In regions where heavy and long winter conditions predominate, managing utilization of feedstuffs and selecting breeds with high survivability and disease resistance are very important profitability of ruminant animal production. Feedstuff shortage and consequently depressed growth, especially for spring-born calves, often is inevitable during the wintering period. Compromised postweaning development can also adversely affect growth, reproductive and lactation performances and leads to greater incidence of mortality. Overfeeding may also limit these performance parameters. Hoffman (1997) reported that overfeeding before the puberty period caused early parturition associated with depressed milk production, suggesting that animals must complete growth and development in order to maintain or replenish body reserve to support production. It is postulated that depressed lactation performance was related to incomplete development of secretory tissues of mammary gland and be resulting from speeding growth rate before the puberty period, with average daily gain ranging from 0.450 to 0.850 kg during 5 months of age (Sejrsen and Purup, 1997). Restricted feeding however slows growth rate and prolongs slaughter age, while minimizing production problems related to growth and development such as abrupt changes in environment, ration and other managerial applications (Loerch and Fluharty, 1998). By increasing nutrient density, compromised growth due to restricted feeding could be eliminated (Knoblich *et al*., 1998). Animals that were exposed to restricted feeding, compensatory growth leads to more preferable performance in late stages compared with their counterparts (Akçapýnar and Özbeyaz, 1999). However, success of restricted feeding and compensatory growth depend on animal age and breed, feeding duration, monitoring body weight change and health status. In our region, winter is bitterly cold and lasts about 7 months. Grazing period is therefore is short. After weaning period, animals have a free choice of dry hay and straw which barely meets maintenance demand in routine animal production. Thus, animals are naturally subjected to restricted nutrient intake to maintain optimal growth rate. In this study, we intended to compare growth characteristics of Holstein, Brown Swiss and their F1 crossbred supplemented with barley during the wintering period.

Materials and Methods

Animal, Diets, Management and Measurements: The Research Animal Ethic Committee of Atatürk University approved this experimental protocol. Twelve Holstein (4 bulls and 8 heifers), 10 Brown Swiss (3 bulls and 7 heifers) and 6 Holstein x Brown Swiss (3 bulls and 3 heifers) spring-born calves, weighing 117.7, 130.5 and 101.7 kg and 218.6, 233.8 and 193.8 days of age, respectively, were obtained from Atatürk University Experimental Research Station. After ending the weaning period, animals were transferred to tie-stall barn. Following a 15-day adaptation

period, calves were utilized for three phases of the wintering period of 168 days, each lasting 56 days. Ad libitum consumption of dry hay and water and free choice of salt as a group feeding by breed was provided throughout the experiment. Animals were weighed every 56 days of period. In order to meet energy and protein demands for maintenance due to growing, animals were also supplemented with 1, 1.25 and 1.50 kg barley daily during these periods. Dry hay and barley contained 91 and 90% dry matter and 7 and 12.8% crude protein, respectively (AOAC, 1990). Body weight change, body weight gain and feed conversion ratio (kilogram feed consumed per kilogram body weight gained) were calculated by period and throughout the experiment for each breed and sex.

Statistics: Body weight measured at the end of adaptation period was employed as a covariate for all response variables. The segmental organization of data by period and overall were subjected to analysis of covariance using SPSS software (SPSS, version 10.0, 1999). The linear model to evaluate growth performance was as follows:
$Y_{ijk} = \mu + C + B_i + S_j + (B*S)_{ij} + e_{ijk}$
where Y_{ijk} = response variable, μ = population mean, C = covariate (initial live weight), B_j = breed, S_j = sex, $B*S_{ij}$ = breed i and sex j interaction and e_{ijk} = experimental error. Statistical significance was declared at probability less than 0.05.

Results and Discusion

Table 1 summarizes growth performance characteristics of postweaned Holstein, Brown Swiss and Holstein x Brown Swiss spring-born bull and heifer calves during the winter period. Initial body weight used as covariate were not different across breeds and sexes, but it was significant for analyses of all response variables. Therefore, values are covariately adjusted the least square means. There were no differences in body weights of animals across breeds and sexes during the first two months of the experiment. In the second period (4th mo.), however, Holstein and its crossbred with Brown Swiss had greater body weight than Brown Swiss, regardless of sex (breed effect, $P < 0.04$). Differences in body weight diminished with greater increase in body weight for heifer calves towards the end of the experiment (sex effect, $P < 0.05$).

Table 1. Growth performance of Holstein, Brown Swiss and Holstein x Brown Swiss calves during the wintering period.[1]

	Holstein (H)		Brown Swiss (BS)		H x BS		Statistical significance, *P* <			
Parameters[2]	Bull (n=3)	Heifer (n=10)	Bul (n=3)	lHeifer (n=10)	Bull (n=3)	Heifer (n=10)	SEM	Breed	Sex	Breed*Sex
Initial BW, kg	115.8	119.6	130.7	130.3	87.7	115.7	13.9	0.23	0.41	0.66
BW, kg										
Day 56	152.0	150.8	144.7	145.3	150.4	152.8	2.6	0.54	0.80	0.82
Day 112	180.9	173.3	168.9	170.6	182.6	174.4	3.0	0.04	0.10	0.24
Day 168	212.0	205.0	206.1	199.6	215.0	206.6	3.8	0.23	0.05	0.98
ADG, kg/d										
Day 1-56	0.59	0.57	0.46	0.47	0.56	0.60	0.05	0.06	0.78	0.82
Day 57-112	0.52	0.40	0.43	0.45	0.57	0.39	0.05	0.82	0.05	0.19
Day 113-168	0.55	0.57	0.67	0.52	0.58	0.57	0.05	0.82	0.30	0.24
Day 1-116	0.55	0.51	0.52	0.48	0.57	0.52	0.02	0.19	0.05	0.98
Feed intake, kg/d										
Day 1-56	4.47		3.97		4.19		0.23	0.0001	---	---
Day 57-112	4.95		4.83		4.75		0.73	0.0001	---	---
Day 113-168	5.91		5.00		5.24		0.72	0.0001	---	---
Day 1-116	5.11		4.60		4.73		0.33	0.0001	---	---
FCR, kg:kg										
Day 1-56	7.71	8.23	9.09	8.70	7.65	7.12	0.63	0.16	0.82	0.69
Day 57-112	9.69	12.88	11.32	11.53	8.97	12.38	1.26	0.88	0.06	0.44
Day 113-168	10.80	10.89	7.43	10.17	9.41	9.36	0.98	0.13	0.31	0.35
Day 1-116	9.32	10.11	8.92	9.64	8.28	9.08	0.43	0.13	0.06	0.99

[1]BW = body weight; ADG = average daily gain; FCR = feed conversion ratio (kilogram feed consumed per kilogram body weight gained). [2]Age of calves was 218.7±27.6 (mean±SD).

Average daily gain during the first period (first two months) tended to be greater for Holstein and Holstein x Brown Swiss than for Brown Swiss (breed effect, $P < 0.06$). In the second period, bull calves gained more considerable body weight than heifer calves (sex effect, $P < 0.05$). Although there were no differences in average daily gains across breeds and sexes, it appears that bull calves gained more body weight than heifer calves during the wintering season, regardless of breed (sex effect, $P < 0.05$).

In this study, animals were group fed by breed. Thus, bull and heifer calves were assumed to consume feed equally. Consequently, the effects of sex and its interaction with breed could not be detected. In all stages of the experiment, feed consumption was the highest for Holstein, followed by Holstein x Brown Swiss and Brown Swiss calves.

Similar to average daily gain, there was neither main effects of breed and sex nor their interaction feed conversion during the first period of the experiment. Because lower growth rate for heifer calves, feed conversion tended to be greater for heifer calves than bull calves during the second period of the experiment (sex effect, $P < 0.06$). Despite no differences in feed conversion ratios across breeds and sexes, heifer calves tented to consume greater amount of feed to gain one kilogram body weight than bull calves during the wintering season, regardless of breed (sex effect, $P < 0.06$).

In heavy winter conditions, grazing is not available, ruminants are fed hay, crop residues, or silage. Hay containing greater than 10% crude protein could be used as sole feed (Jurgens, 1996) and growth rate should be ranging from 0.34 to 0.59 kg/d during 7 to 15 months of age to develop replacement heifers and bulls. By this growth rate, it is targeted to reach 270-320 kg body weight at the end of spring season before being released to range for grazing. Because forage was less quality and contained less than 10%, grain supplementation is necessary in order not to compromise growth as suggested by Loerch and Fluharty (1998) and Jurgens (1996). Main purpose of wintering is to reduce investment cost without compromising growth performance and to achieve 250-270 kg body weight before grazing season (Lardy, 1998). Results of studies conducted by Schoonmaker *et al.* (2004a) who utilized Angus x Simmental and Schoonmaker *et al.* (2004b) who utilized Holstein support the recommendation that high quality hay provides sufficient amount of nutrients to meet demands for growth.

Wertz *et al.* (2001) offered free choice of corn and restricted dry hay growing replacement heifers and reported that heifers had restricted to dry hay gained lower body weight than those had free access to forage mixture. In other studies, yielding 450 and 900 g body weight gains were achieved by offering 5 kg dry hay plus 1.8 kg grain supplementation and 4.5 kg dry hay plus 2.8 kg grain supplementation, respectively (Rasby *et al.*, 1994) and yielding 0.64 kg body weight gain from month 9 to 12 was achieved by consuming 5.28 kg dry matter (Cassar-Malek *et al.*, 2001). By experimenting with 9 months of old Belgium Blue bull calves, Horninck *et al.* (1998) offered a ration containing low energy and protein and reported that average daily gain was 0.57, 0.54 and 0.44; feed intake was 5.9, 5.9 and 6.4 kg per day and feed conversion was 10.21, 11.21 and 14.42 on day 114, 239 and 411 relative to initiation of the experiment, respectively. Performance variables presented in this study were also agreement with previous research conducted in the same region (Tüzemen *et al.*, 1996), in which body weight at age of one year was 244 kg for Holstein and 220 kg for Brown Swiss, respectively. Crossbred of Limousine, Brangus and Simmental with Jersey were reported to have lower body weight and other growth performance characteristics (Özbeyaz *et al.*, 1996). Regardless of breeds, animals in this study gained body weight within the recommended levels as in agreement with previous studies mentioned above. Overall growth performance parameters among breeds did not differ. Differences in those between bulls and heifer could be related to assuming that feed intake was equal because body weight and change in body weight by sex were not different, suggesting that before puberty when hormonal changes are not abruptly fluctuated, nutrient partitioning should be the same. Moreover, as the experiment continued, fluctuation in feed conversion could be related to adaptation to changes in environmental conditions.

In conclusion, supplementing with grain when high quality forages unavailable does not compromise growth performance during the wintering season. Moreover, there were no performance differences among breeds from postweaning period to puberty. Feeding growing calves nutritionally balanced ration helps to achieve optimum body weight for subsequent successful reproductive performance.

References

Akçapinar, H. and C. Özbeyaz, 1999. *Hayvan Yetiþtiriciliði Temel Bilgileri*. Ankara Üniversitesi Veteriner Fakültesi Zootekni Anabilim Dali. Kariyer Matbaacilik Ltd. Şti., Ankara, Turkey.

Association of Official Analytical Chemists. 1990. Official Methods of Analysis. 15th ed. AOAC, Arlington, VA.

Cassar-Malek, I., S. Kahl, C. Jurie and B. Picard, 2001. Influence of feeding level during postweaning growth on circulating concentrations of thyroid hormones and extrathyrodial 5´-deiodination in steers. J. Anim. Sci., 79: 2679- 2687.

Hoffman, P. C., 1997. Optimum body size of Holstein replacement heifers. J. Anim. Sci., 75:836-845. Hornick, J. L., C. van Eenaeme, A. Clinquart, M. Diez and E. Istasse, 1998. Different periods of restriction before compensatory growth in Belgian Blue bulls: I. Animal performance, nitrogen balance, meat characteristics and fat composition. J. Anim. Sci., 76:249-259.

Jurgens, M. H., 1996. *Animal Feeding and Nutrition*, 8th ed. Kendall/Hunt Pub. Co., Dubuque, IA. Knoblich, H. V., F. L. Fluharty and S. C. Loerc. 1997. Effects of programmed gain strategies on performance and carcass characteristics of steers. J. Anim. Sci., 75: 3094-3102.

Lardy, G., 1998. Systems for Backgrounding Beef Cattle. North Dakota University Extention Service, Report No: AS-1151, ND.

Loerch, S. C. and F. L. Fluharty., 1998. Effects of programming intake on performance and carcass characteristics of feedlot cattle. J. Anim. Sci., 76:371-377.

Özbeyaz, C., C. Baðcý, T. Yağci and O. Alpan, 1997. Brangus, Limosin ve Simmental boðalarla Jersey ineklerden et üretimi için kullanma melezleri elde edilmesi. Lalahan Zootekni Araþtýrma Enstitüsü Dergisi, 37:1-22.

Raspy, R., I. Rush and R. Stock, 1996. Wintering and Backgrounding Beef Calves. University of Nebraska. Institute of Agriculture and Natural Resource. File G1228 under: Beef A-45, Feeding and Nutrition. Paper version issued October1994, Electronic version issued, Lincoln, NE.

Schoonmaker, J. P., M. J. Cecava, F. L. Fluharty, H. N. Zerby and S. C. Loerch, 2004a. Effect of source and amount of energy and rate of growth in the growing phase on performance and carcass characteristics of early-and normal-weaned steers. J. Anim. Sci., 82:273-282.

Schoonmaker, J. P., F. L. Fluharty and S. C. Loerch, 2004b. Effect of source and amount of energy and rate of growth in the growing phase on adipocyte cellularity and lipogenic enzyme activity in the intramuscular and subcutaneous fat depots of Holstein steers. J. Anim. Sci., 82:137-148.

Sejrsen, K. and S. Purup, 1997. Influence of prepubertal feeding level on milk yield potential of dairy heifers: A review. J. Anim. Sci., 75: 828-835.

Tüzemen, N., Ö. Akbulut and M. Özhan, 1996. Esmer ve Siyah Alaca Siğirlarin Erzurum Koşullarinda Bazi Önemli Özellikler Bakimindan Karşilaştirilmasi. Ege Üniv. Ziraat Fak. Zootekni Bölümü, Hayvancilik '96 Ulusal Kongresi. Cilt 1: Bildiriler. 18-20 Eylül 1996 Izmir, Turkey.

Wertz, A. E., L. L. Berger, D. B. Faulkner and T. G. Nash, 2001. Intake restriction strategies and sources of energy and protein during the growing period affect nutrient disappearance, feedlot performance and carcass characteristics of crossbred heifers. J. Anim. Sci., 79:1598-1610.