PRELIMINARY RESULTS FOR RESIDUAL CORRELATIONS OF IGF-I WITH PERFORMANCE TRAITS IN KOREAN NATIVE CATTLE (HAN WOO)

No Hyoung Park, Oun Yik Shin, Keun kie Jeung and Chang Bon Choi

Korean Native Cattle Improvement Center 6-10 Wonbul, Unsan, Sosan, Chungnam 352-830 Korea
Dept. of Animal Science, Yeung Nam University, Kyung San, Kyungbuk, 712-749, Korea

SUMMARY

The generally positive correlation between circulating IGF-I concentrations at early ages and performance traits indicates that IGF-I may serve as a useful indicator of growth capacity in beef cattle. Serum IGF-I concentration might be used as a component of selection indices, along with other physiological predictors of performance and performance traits, to improve efficiency of beef production.

INTRODUCTION

Insulin-like growth factor I (IGF-I), Somatomedin C, is a basic 70 amino acid single chain polypeptide with approximately 7,000 MW (Honegger and Humbel, 1986). IGF-I mediates the growth-promoting and metabolic actions of growth hormone and has insulin-like effects (Zapf and Froesch, 1986). Besides the liver, which has been considered the primary source of circulating IGF-I that acts as an endocrine hormone, IGF-I is also produced in a wide variety of tissues and organs, primarily stimulated by growth hormone, and acts in an autocrine/paracrine fashion (Han et al., 1987). IGF-I is currently under intensive study in farm animals because it is a heritable characteristic (Park et al., 1992) and because of its influence on growth (Davis and Bishop, 1993).

If circulating IGF-I does play a major regulatory role in growth of meat producing animals, then variation in this hormone may contribute to production differences among animals. Thus, improvement in efficiency of animal production will come with increased understanding of the nature of IGF-I's influence on production traits. The specific objective study of this study was to determine the correlations of serum IGF-I concentrations with performance traits (weights and gains).

MATERIALS AND METHODS

Description of animals. Four hundred and forty six Fall-calving purebred Korean Native Cattle (Han Woo) cows located at the Korean Native Cattle Improvement Center were bred in Fall 1991. Eleven selected sires for progeny testing were used for breeding and eighty eight bulls (eight bulls from each sire) were selected from 150 produced bulls in Fall, 1992.

Description of data. Weight of all bulls was recorded at birth, weaning, beginning of postweaning test and at end of each 30-d period until d 160. Blood was also collected at the same time except at birth and weaning.

Management procedures. Bull calves were reared by their dams without the aid of creep or additional feed until weaning at approximately 150 d of age. Following weaning, bull calves were fed ad libitum with a corn-soybean meal based concentrate diet and pellet.

Serum samples. Approximately 15 ml of blood was collected into sterile 16 x 150 mm glass tubes via jugular puncture of each animal. The blood was allowed to clot for 24 h at room temperature. Serum was then obtained by centrifugation (1,800 x g for 20 min) and frozen at -20 ° C until assayed.

Radioimmunoassay (RIA) for IGF-I. The RIA for IGF-I was performed using procedures described by Diagnostic Systems Laboratories (DSL5600). Briefly, following acid-ethanol extraction to remove binding proteins, each sample was diluted in assay buffer and assayed in duplicate using human recombinant IGF-I as standard and iodinated tracer. Antisera raised against human IGF-I in mouse was used. Concentrations of IGF-I in serum samples were calculated from the standard curve.

Statistical analysis. Residual correlations of mean IGF-I concentration and IGF-I concentrations at different ages with birth weight, weaning weight and postweaning performance traits were obtained using the MANOVA provided by PROC GLM procedure (SAS, 1982). Thus, correlations were computed after removing variation due to sire of calf, age of dam, on-test age of calf (deleted from the model for analysis of birth weight; weaning age was used instead of on-test age for analysis of weaning weight), and important ($P < .20$) two-factor interactions.

RESULTS AND DISCUSSION

This study examined the relationship of circulating IGF-I with growth in Korean Native Cattle (Han woo). Simple means, standard deviations and coefficients of variation for variables involved in this study are presented in Table 1. Shown in Table 2 are correlations of IGF-I with performance traits of calves. All traits, other than weaning weight (WEANWT), were positively correlated with on-test serum IGF-I concentrations (ONTSTIGF). Residual correlations of ONTSTIGF with on-test weight (ONTSTWT), postweaning weights at d 60 (WT60), 100 (WT100), 130 (WT130), and 160 (WT160) were .25, .24, .38, .39, and .36, respectively ($P < .05$ in all cases). and with postweaning weight at d 30 (WT30) was .23 ($P < .10$). Correlations of IGF-I concentration measured postweaning at d 30 (IGF30) with WT100 and WT160 were .37, and .33, respectively ($P < .05$ in all cases). Correlation with WT30, WT60, and WT130 were .31, .26, and .26, respectively ($P < .10$ in all cases). Residual correlations of mean of IGF-I concentrations (MEANIGF) with WT30, WT60, and WT100 were .27, .24, and .33, respectively ($P < .05$ in all cases). Residual correlations of performance traits with IGF-I concentrations measured postweaning at d 60 (IGF60), 100 (IGF100), 130 (IGF130), and 160 (IGF160) were near zero in most cases and nonsignificant. Results obtained indicated that bulls with higher serum IGF-I concentrations at the beginning of the postweaning test had larger weights at the beginning of test, and at d 60, 100, 130, and 160. IGF-I concentrations measured at postweaning d 30 were also related to postweaning performance. Therefore, ONTSTIGF and IGF30 may be useful to predict postweaning performance of calves. These results are in agreement with work of Park (1993), which showed that positive correlations of serum IGF-I level measured at on-test and postweaning at d 28 with postweaning performance traits (correlations ranged from .15 to .39) in Angus beef cattle. Positive correlations of IGF-I concentrations with weights and gains also have been reported for beef cattle (Davis and Bishop, 1991).

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Table 1. SIMPLE MEANS, STANDARD DEVIATIONS AND COEFFICIENTS OF VARIATION FOR TRAITS

Traits[a]	N	Simple mean	Standard deviation[b]	Coefficient of variation (%)
BIRTHWT	88	23.9	1.91	7.97
WEANWT	88	107.6	11.22	10.43
ONTSTWT	88	193.2	22.23	11.51
WT30	88	217.9	24.79	11.37
WT60	88	244.9	26.26	10.72
WT100	88	321.7	25.07	7.79
WT130	88	362.4	32.52	8.97
WT160	88	381.8	32.69	8.56
ADG160	88	1.18	11.67	.14
ONTSTIGF	87	573.1	178.18	31.09
IGF30	88	387.1	128.70	33.25
IGF60	85	328.9	101.42	30.84
IGF100	88	556.6	211.33	37.97
IGF130	88	661.5	104.33	15.77
IGF160	88	626.2	61.34	9.79
MEANIGF	88	523.2	65.76	12.57

[a] Kg for weights and ng/ml for IGFs.

[b] Computed as square root of the error mean square after removing variation due to independent variables described in Materials and Methods.

Table 2. RESIDUAL CORRELATIONS OF IGF-I WITH PERFORMANCE TRAITS

	ONTSTIGF	IGF30	IGF60	IGF100	IGF130	IGF160	MEANIGF
BIRTHWT	.05	.06	.01	-.01	-.25	.03	.01
WEANWT	-.04	.02	-.06	.14	.02	.01	.08
ONTSTWT	.25**	.20	-.001	.06	.09	.06	.23*
WT30	.23*	.31*	.10	.01	.11	.08	.27**
WT60	.24**	.26*	.07	-.02	.14	.06	.24**
WT100	.38**	.37**	.04	.05	.08	-.01	.33**
WT130	.39**	.26*	.06	-.06	.01	.10	.26*
WT160	.36**	.33**	.05	-.02	.02	.06	.27*
ADG160	.15	.29*	.01	-.06	.13	-.08	.15

* $P < .10$

** $P < .05$