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GENETIC RELATIONSHIPS AMONG FEED INTAKE MEASURES, FEED CONVERSION EFFICIENCY, AND MILK PRODUCTION TRAITS IN HOLSTEINS USING FIELD RECORDED DATA

by

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ABSTRACT

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A total of 114,351 Holstein first lactation records collected by the Quebec Dairy Herd Analysis Service (DHAS-PATLQ) between September, 1979 and January, 1994 were used to study the effects of adjusting records for linear and quadratic effects of 90- and 305-d feed intake measures (total energy, total protein and total dry matter) on estimation of heritabilities of and genetic correlations among yield and composition traits. Genetic parameters of feed intake measures, relationships between feed intake and age and weight at calving, and feed conversion efficiency traits were also examined in a series of studies. A sire model fitted by REML estimated heritabilities of 305-d milk, fat and protein yields, fat and protein percents as .45±.04, .48±.04, .44±.03, .92±.06, and .88±.05, respectively. Correction of 305-d records for differences among cows in feed intake levels reduced heritabilities of milk, fat and protein yields to .35±.03, .52±.04, and .38±.03, respectively. Heritabilities of composition traits (fat and protein percents) remained unchanged. Genetic and phenotypic correlations for yield traits were also reduced (48-170%, and 16-51%, respectively) which may indicate that genetic associations between yield traits are less than what we believed them to be. Heritabilities of 305-d total energy, total protein, total DM intake, grain energy, grain protein, grain DM, base energy, base protein, and base DM were .30±.03, .24±.02, .35±.03, .23±.02, .23±.02, .23±.02, .31±.03, .26±.02, and .40±.03, respectively. Genetic correlations between feed intake measures were very high; they were approaching unity in some cases. Therefore, any one of these feed intake measures can represent the others. A multi-trait REML analysis estimated heritabilities of age and weight at first calving as .11±.01 and .37±.03, respectively. Age at calving was negatively associated with yield traits and with total energy intake but the standard errors were high. Genetic correlations of weight at calving with milk, fat and protein yields were negligible; they were -.05±.06,

.06±.06, and .00±.06, respectively. Weight at calving had negative genetic correlations with gross efficiency measures. Accordingly, heavier heifers at calving are expected to be less efficient in converting feed into milk. The response of milk yield to extra energy supply was higher at early lactation compared to that for whole lactation. An increase in feed by one Mcal energy resulted in an increase of .33 - .69, .011 - .025, and .009 - .019 kg milk, fat and protein yields, respectively. Composition traits showed no response to addition of energy to the diet. Corrected milk yield (CMY) and net efficiency of milk yield (NEMY) as alternate measures for feed efficiency were more accurate than the traditional gross efficiency measures (yield/intake) in expressing individual cow's conversion ability of feed into milk. The estimated heritabilities of CMY and NEMY were .48±.04 and .35±.00, respectively. Estimates of heritabilities, genetic and phenotypic correlations among all the traits were lower at 90-d of lactation than corresponding values at 305-d.