

**HERITABILITY OF TEMPERAMENT IN  
CANADIAN HOLSTEINS****J. F. Hayes****Summary**

Records for temperament scores on 335,840 cows from July 1990 to April 1995 were obtained from the Quebec Dairy Herd Analysis Service (PATLQ) for the purpose of estimating heritability of temperament. After editing the data, there remained records on 232,064 first lactation Holstein daughters of 1498 Holstein sires distributed in 44,380 herd-year-seasons. Temperament was recorded as 1) very nervous, 2) nervous, 3) average, 4) quiet and 5) very quiet. Prior to analysis the temperament scores were transformed to snell scores. The data were then analysed using a model that included herd year-season and age classes as fixed effects, milking speed, test day milk yield and days in milk (linear and quadratic) as covariates, and sire and error as random effects. The model, which incorporated the relationship matrix, was fitted by REML. The estimate of heritability for temperament was  $.05 \pm .005$ .

Keywords: dairy cattle, temperament, heritability

*Introduction*

There have been few studies of temperament in dairy cattle reported in the literature. Most studies involve a comparison of means between breeds (e.g. Khanna and Sharma 1988; Kabuga and Appiah 1992). Sullivan and Burnside (1988) reported heritabilities for three measurements of temperament in Canadian Holsteins and correlations of sire proofs for these

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Rad je priopćen na "6<sup>th</sup> World Congress Genetics Applied to Livestock production", Armidale, 1998.

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measurements with sire proofs for economically important traits. Heritability estimates for milking behaviour, ease of handling and aggressiveness at feeding were .16, .12 and .11 respectively. Correlations with economically important traits were very low. However, their results were based on a small data set for temperament. More recently Cue et. al. (1996) reported a heritability estimate of .137 for temperament in New Zealand Holsteins.

Data on temperament have been collected on Holstein cows enrolled in the Quebec Dairy Herd Analysis Service Program (PATLQ) since July 1990. The rationale for the collection of data on temperament is that temperament of the cow is considered to be a trait that affects the ease with which the cow is handled and in particular it is related to the amount of labour input that is required at milking time and, therefore, labour costs. The objective of the present study was to estimate the heritability of temperament in Canadian Holsteins using the large field data set on temperament available from PATLQ.

### *Materials and methods*

*Data and editing.* Temperament has been recorded since July of 1990 for cows enrolled on PATLQ. It is recorded once in first lactation heifers according to the following five codes: 1) very nervous 2) nervous, 3) average, 4) quiet and 5) very quiet. The code refers to temperament as observed by the dairyman in the milking parlour at milking time. The data for the present study were from July 1990 to April 1995, inclusive. In total, 335,840 temperament records were retrieved from PATLQ with breed codes for Holsteins, Ayrshires, Jerseys, Guernseys Brown Swiss, Shorthorn, Canadienne and Crossbreds. After eliminating cows with duplicate records and invalid codes for temperament, there were 273,918 records. A further 461 records had missing sire registrations, leaving 273,457 records. Of these, 248,555 records were daughters of Holstein sires. Further editing of this Holstein data set resulted in 81 records being removed because of missing birth dates and missing calving date, 2,330 records because age at calving was less than 18 months or greater than 40 months, and 14,080 records were removed because they belonged to sires with less than 5 progeny in less than 5 herds. A total of 232,064 records remained for analysis. A summary of the data and edits is presented in Table 1.

Table 1. - TOTAL NUMBER OF RECORDS FOR TEMPERAMENT, AND NUMBERS OF RECORDS REMOVED FOR VARIOUS REASONS

Reason for removal	Number of records
Duplicate records and invalid temperament scores	61,922
Missing sire registrations	461
Non- Holsteins sires	24,902
Missing birth dates and missing calving dates	81
Age at calving less than 18 months or greater than 40 months	2,330
Records of sires with less than 5 progeny in less than 5 herds	14,080
Initial total numbers of records	335,840
Records remaining for analysis	232,064
Number of sires in data	1,498
Number of herd-year-seasons	44,380

*Statistical analysis.* The 232,064 temperament records were analysed using each of the following models.

- (1)  $y_{ijkl} = hys_i + age_i + bdim + bdim^2 + bms + bmy + s_k + e_{ijkl}$
- (2)  $y_{ijkl} = hys_i + age_i + bdim + bdim^2 + bms + s_k + e_{ijkl}$
- (3)  $y_{ijkl} = hys_i + age_i + bdim + bdim^2 + bmy + s_k + e_{ijkl}$
- (4)  $y_{ijkl} = hys_i + age_i + bdim + bdim^2 + s_k + e_{ijkl}$

where

$y_{ijkl}$  = temperament record

$hys_i = i_{th}$  herd-year-season (44,380 classes)

$age_i = j_{th}$  age at calving (21 month classes)

$dim$  = days in milk as a covariate

$ms$  = milking speed as a covariate

$my$  = test-day milk yield as a covariate (linear and quadratic)

$b$  = regression coefficient for a given covariate

$s_k = h^{th}$  random sire effect (1619 sires)

$e_{ijkl}$  = random error

There were two seasons i.e. March to September and October to February. The relationship matrix was constructed using information on sires of sires only (i.e., relationships on the dam side of the pedigree were ignored). The total number of sires was 1619 i.e., 1498 sires with daughters in the data set, plus 121 male ancestors who did not have daughters in the data set. The model was fitted by REMI using the algorithm of Meyer (1985). Prior to analysis, the temperament scores were transformed to Snell scores (Snell, 1964) so as to stabilize the variance in the herd-year-season subclasses. The Snell scores were 1.0, 1.88, 2.83, 3.94 and 5.

### Results and discussion

From model (1), the fixed effects of herd-year-season and age at calving were highly significant and regression coefficients on milking speed, days in milk (linear and quadratic) and test-day milk yield were all highly significant, though the sizes of the regression coefficients were small in all cases. The regression coefficient of temperament on each of milking speed, test-day milk yield and days in milk (linear) was positive (i.e., temperament improved as milking speed, test-day milk yield and days in milk increased), but the quadratic regression on days in milk was negative.

Estimates of heritability of temperament obtained under each of the four models of analysis are presented in Table 2. The models differed in the covariates they included, and estimates of heritability were obtained under each model as each appeared to be a reasonable model for analysis of temperament. However, the heritability estimates for temperament were essentially the same i.e. .05 for all models of analysis (Table 2). The heritability estimate of .05 for temperament in the present study was smaller than had been expected, and smaller than in reports by Sullivan and Burnside (1988) based on a much smaller data set for Canadian Holsteins, and Cue et al. (1996) using a different scoring method for temperament in New Zealand Holsteins.

Table 2. - HERITABILITY ESTIMATES ( $h^2$ ) AND THEIR STANDARD ERRORS (S.E.) FOR TEMPERAMENT

Model	$h^2$	s.e.
1	.051	.0052
2	.053	.0054
3	.050	.0052
4	.053	.0053

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## NASLJEDNOST TEMPERAMENTA U KANADSKOG HOLSTEINA

### Sažetak

Od službe za analizu mliječnog stada u Quebecu /PATLQ dobiveni su zapisi skorova/bodova temperamenta 335,840 krava od srpnja 1990. do travnja 1995. radi procjenjivanja nasljednosti temperamenta. Nakon obrade podataka ostali su zapisi o 232,064 prvih laktacija Holstein kćeri 1498 Holstein rasplodnjaka raspoređenih u 44,380 sezona godine stada. Temperament je zabilježen kao 1. vrlo nervozan, 2. nervozan, 3. prosječan, 4. miran i 5. vrlo miran. Prije analize, bodovi temperamenta pretvoreni su u Snell bodove. Podaci su zatim analizirani primjenom modela koji je uključio sezonu godine stada i starosne razrede kao i stalne učinke, brzinu izdajanja, prinos mlijeka na dan testiranja i mliječne dane (linearno i kvadratično) kao kovarijante, te rasplodnjaka i pogrešku kao slučajne učinke. Model, koji je obuhvaćao matricu srodstva, postavljen je po REML-u. Procjena nasljednosti za temperament bila je  $.05 \pm .005$ .

Ključne riječi: mliječno govedo, temperament, nasljednost

Primljeno: 2. 2. 1999.