Acta vet. scand. 1986, 27, 182—195.

From the Department of Animal Hygiene, College of Veterinary Medicine, Helsinki and the Finnish Animal Breeding Association, Vantaa, Finland.

AN EPIDEMIOLOGICAL AND GENETIC STUDY ON REGISTERED DISEASES IN FINNISH AYRSHIRE CATTLE

I. THE DATA, DISEASE OCCURRENCE AND CULLING

By

Yrjö Gröhn, Hannu Saloniemi and *Jouko Syväjärvi*

GRÖHN, YRJÖ, HANNU SALONIEMI and JOUKO SYVÄJÄRVI: *An epidemiological and genetic study on registered diseases in Finnish Ayrshire cattle. I. The data, disease occurrence and culling.* Acta vet. scand. 1986, 27, 182—195. — The epidemiology and genetic variability of the most common dairy cow diseases were examined. This paper describes the data set, lactation incidence rates and culling during lactation. The data set consisted of the lactation records of 73,368 Finnish Ayrshire dairy cows. Each cow was under observation for 2 days before and 305 days after calving. Lactational incidence rates (%) for the most common diseases were: ovulatory dysfunction 7.0, ketosis 6.0, acute mastitis 5.4, anoestrus and suboestrus 5.2, retained placenta 4.5, parturient paresis 3.8 and teat injury 2.6. Multiple logistic regression was utilized to investigate the possible effects of certain factors on culling. The model predicted the log odds for culling as an additive function of the explanatory factors. Using the estimated odds and forming the odds ratios it was possible to investigate relative risks between any combination of groups of the explanatory factors. The risk of culling increased with parity after the second parturition, and with increasing herd milk yield. Mastitis and parturient paresis had positive associations with culling, while ketosis and infertility had negative associations. Heritability estimates for culling in various parity groups were from 2 % to 9 % on the binomial scale corresponding from 5 % to 14 % on the normal scale. There was a neagtive genetic correlation between culling and previous milk production.

health documentation; incidence; logistic regression; dairy cattle.

One of the greatest needs in veterinary medicine today is the perfection of comprehensive epidemiological intelligence systems (*Schwabe et al.* 1977). The nature of the diseases in the intensive animal production systems of developed countries differ from those of previous systems (*Schwabe* 1982). Control of diseases responsible for excessive mortality prepared the ground for clinical care of individual animals but today even this approach is quite ineffective in intensive animal production units, where diseases manifest themselves principally through impairment of production efficiency, often without obvious clinical signs (*Blood et al.* 1978). Thus, current investigation requires identification, quantification, and intensive examination of multiple, directly or indirectly causal, and often interacting, disease determinants. There is a clear need for an epidemiological approach that provides accurate documentation of the importance of different diseases and their effects on production efficiency.

Although many studies have been carried out to determine the occurrence of individual diseases of dairy cattle, there have been very few investigations at the state level that could assess the relative importance of various diseases. The obvious reason for this is the lack of comprehensive surveillance programs for common diseases at the herd level. Health data recording systems instituted in different Nordic countries were founded to satisfy this need (*Saloniemi* 1982, *Solbu* 1983). In the spring of 1982, a new health recording system was started for all Finnish dairy farms. The objectives of the system were defined as 1) to improve the health care of an individual animal, 2) to make it possible to design a health program for an entire herd or livestock unit, and 3) to make it possible to include health data in the breeding program.

The purpose of the current study was to examine the epidemiology and genetic variability of the most common diseases of dairy cattle. The special objectives of this paper are to describe the data set, to investigate the occurrence of the most common dairy cow diseases and to investigate the effects of possible risk factors on culling during lactation.

MATERIALS AND METHODS

Data collection

The health data recording system instituted in Finland combines 3 different sources of information: veterinary records, milk production records and artificial insemination (AI) statistics.

Each cow at a farm has an insemination and health card with the identification and pedigree data. Inseminations are marked on the card by local AI technicians and calvings are recorded by the dairymen. The veterinarian notes the date of his visit to the farm, diagnosis, time of treatment, his own code and medicine used. Cases handled via the telephone are noted by the dairymen. The AI technician transfers the data via AI centres to the Agricultural Data Processing Centre where milk production and insemination data are recorded, as well.

Study population

The data for this study include the cows that calved during the period between January 1, 1983 and December 31, 1983. Each cow was under observation for 2 days before and for 305 days after calving. Finnish Ayrshire cows, which belonged to the milk registry and had health data available formed the original study population.

Disease occurrence and culling

A cow was considered to have a disease if it had been clinically diagnosed or if treatment had been given for it by a local veterinarian during the study period. The cases treated by telephone prescription were excluded. Only the first diagnosis for each disease was considered. The diagnoses were handled as they were coded on the health card, but in the statistical analysis for culling the code "infertility" included ovulatory dysfunction, anoestrus, suboestrus, infection of the reproductive tract post partum and other infertility, and the code "mastitis" included mastitis acuta and chronica.

The term lactational incidence rate (LIR) was used (*Erb & Martin* 1980). LIR was defined as the number of cows with at least one occurrence of a disease during a lactation period (within two days before and 305 days after calving) divided by the number of cows at risk during the same period of time, expressed as a percentage. LIR is the same as the incidence rate for those diseases which can occur only once during a lactation.

Culling was also investigated during the lactation period. Because there were only 208 Finnish Ayrshire cows (1.6 % of removals) which were sold for continued dairy use, all removals were handled as culled.

Validation of the data

The data of the health recording system were validated by comparing selected samples of records with official statistics in Finland (*Teittinen* 1985). The comparison revealed that the validity of the health data improved with increasing health recording percentage, i.e. with increasing proportion of farms that had the health data available in the community. The health recording percentage of the community had to be equal to or greater than 70 % to be included in the study population. Eighty-seven of 461 communities fulfilled this requirement. Because only farms belonging to the milk-recording organization were analysed, the health register of the farms was almost complete.

Maximum and minimum values for all variables were also obtained and validated. All illogical values were handled as missing values.

Statistical analysis

All statistical analyses of the data were carried out using the Statistical Analyses System (*Ray* 1982). For the analysis of removals within 305 days post partum, a data set consisting of each cow's last lactation during the study period was used. The relationship between certain diseases and culling within 305 days post partum were determined using a logistic regression model (*Cox* 1970, *Feinberg* 1980). This model predicts the log odds (logit) for culling as an additive function of main effects and interaction effects of the explanatory factors. The odds ratio was used as an approximate measure of relative risk. Odds ratios greater than one imply an increased risk of culling and odds ratios less than one imply a decreased risk of culling (*Fleiss* 1981).

Based on biological consideration several models were fitted to the data. Maximum likelihood estimation was used and the goodness of fit for each model was assessed by comparing the value of the likelihood ratio statistics (G^2) with percentage points of the Chi-square statistic. The statistic G^2 is additive under partitioning for nested models and allows investigation of whether additional effects significantly contribute to the model.

For genetic analysis, components of sire and error variances for two traits (culling with 305-days post partum and milk production in the previous lactation and for the sum of those) were estimated by the mixed-model least square procedure (*Freund & Littell* 1981). The 305-day milk production was expressed as the deviation from the mean of herd's milk production level. Only those sires, which had at least 25 daughters were included in the analysis. The model included fixed calving season (December-March, April-July, August-November), fixed herd milk production level (< 4870 kg, < 6150 kg, ≥ 6150 kg) effects and random sire and error effects. Error and sire covariances were estimated as half the difference between the respective variance of the summed trait minus each of respective variances of culling and production.

Heritabilities were estimated as the ratio of 4 times the sire variance to the sum of the estimated sire and error variances. The genetic correlation were computed using the standard formula. The standard error of heritabilities were computed using the formula of *Swiger et al.* (1964) and the standard error of genetic correlations were estimated according to *Robertson* (1959).

Because culling was expressed on a binomial scale the estimates of heritabilities were corrected by the factor $P(1\text{-}P)/z^2$, where P = relative frequency of culled cows and z = ordinate at point P of the normal distribution (*Dempster & Lerner* 1950).

RESULTS

There were 73,368 Finnish Ayrshire dairy cows in the study population. The data came from 7,326 herds and the mean number of cows per herd was 12.2. The distribution of the herds by the number of cows per herd was ≤ 5 cows = 13.2 %, 6—10 cows = 33.0 %, 11—15 cows = 27.5 %, 16—20 cows = 15.8 %, 21—25 cows = 6.9 %, and ≥ 26 cows = 3.6 %.

Table 1 presents means and standard deviations of production parameters for the study population, as well as statistics from Finland's milk registry for 1983. The LIR and median time to first diagnosis for the ten most common diseases are given in Table 2. Altogether 36.2 % of Ayrshire dairy cows were treated at least once by a veterinarian for some kind of disease.

The selected model to explain culling within 305 days post partum included 6 main effects: parity, calving season, herd class average for milk, infertility, ketosis, parturient paresis and mastitis. Four interaction terms were also needed: parity × in-

Table 1. Means and standard deviations (SD) of production parameters (305 days) for 73,368 Finnish Ayrshire cows and means for all 303,213 milk registry cows in Finland in 1983.

Variable	Mean	SD	All milk registry cows
Lactation milk yield, kg	5487	1121	5339
Lactation fat yield, kg	244	51	235
Lactation protein yield, kg	180	37	175
Lactation FCM (4 %) yield, kg	5860	1175	5661
Live weight, kg	492	56	487
Parity	3.1	2.1	N.A.
Calving interval, days	379	41	383

N.A. = not applicable.

fertility, parity × ketosis, parity × parturient paresis and parity × mastitis. The G^2 statistic for this model was non-significant ($P = 0.1161$), implying a reasonable fit to the data. All interactions present in the model were significant and further inclusion of interaction effects did not substantially improve the fit.

Table 3 lists the estimated values for the main effect and interaction effect parameters of culling in the logistic regression model. The interaction effect is given for disease present and is taken with opposite sign for disease absent. For instance, the

Table 2. Rates of cases treated by veterinarians and median time to first diagnosis for 73,368 Finnish Ayrshire dairy cows.

Disease	Lactation incidence fate (%)	Median time to first diagnosis (days post partum)
1. Ovulatory dysfunction	7.0	93
2. Ketosis	6.0	28
3. Mastitis acuta	5.4	34
4. Anoestrus, suboestrus	5.2	90
5. Retained placenta	4.5	2
6. Parturient paresis	3.8	1
7. Teat injury	2.6	78
8. Infection of the reproductive tract post partum <42 days	2.5	15
9. Other infertility	1.9	129
10. Mastitis chronica	1.5	64
All first treatments	50.2	
Percentage of cows treated	36.2	

Table 3. Estimate of the parameters included in the logit model used in the analysis of culling for 73,368 Finnish Ayrshire cows.

Parameter	Estimated value	Parameter	Estimated value
Intercept	—1.266		
Parity	0.024	Parity × Infertility	
1	0.024	1	0.082
2	—0.200	2	0.105
3—4	—0.099	3—4	0.006
5—6	0.015	5—6	—0.126
>6	0.260	>6	—0.067
Calving season		Parity × Ketosis	
December—March	0.019	1	—0.066
April—July	0.087	2	0.150
August—November	—0.106	3—4	0.034
		5—6	0.020
Herd class milk yield (kg)		>6	—0.138
<4870	—0.117	Parity × Parturient paresis	
<6150	0.018	1	0.534
≥6150	0.100	2	—0.053
		3—4	—0.062
Infertility		5—6	—0.185
yes	—0.210	>6	—0.234
no	0.210		
Ketosis		Parity × Mastitis	
yes	—0.125	1	0.070
no	0.125	2	0.059
		3—4	0.001
Parturient paresis		5—6	—0.046
yes	0.313	>6	—0.084
no	—0.313		
Mastitis			
yes	0.232		
no	—0.232		

expected odds of culling for the cows with parity > 6, spring calving season, highest herd milk yield, and the disease history of parturient paresis and mastitis are:

$e^{(-1.266 + 0.260 + 0.087 + 0.100 + 0.210 + 0.125 + 0.313 + 0.232 + 0.067 + 0.138 - 0.234 - 0.084)} = e^{-0.0520} = 0.95$ (equal to 49 % risk of culling).

Analogously the cows with parity 2, autumn calving season, lowest herd milk yield, infertility and ketosis have odds of:

Table 4. Estimated odds (percentage probabilities in parenthesis) of culling for 73,368 Finnish Ayrshire cows. See the explanation in the text.

Calving season			Herd class milk yield (kg)		
Dec.—March	0.29	(22.5)	< 4870	0.25	(20.0)
April—July	0.31	(23.7)	< 6150	0.29	(22.5)
August—Nov.	0.25	(20.0)	≥ 6150	0.31	(23.7)

Parity	Infertility yes	Infertility no	Ketosis yes	Ketosis no	Parturient paresis yes	Parturient paresis no	Mastitis yes	Mastitis no
1	0.25	0.33	0.24	0.35	0.67	0.12	0.39	0.21
	(20.0)	(24.8)	(19.4)	(25.9)	(40.1)	(10.7)	(28.1)	(17.4)
2	0.21	0.26	0.24	0.23	0.30	0.18	0.31	0.17
	(17.4)	(20.6)	(19.4)	(18.7)	(23.1)	(15.3)	(23.7)	(14.5)
3—4	0.21	0.31	0.23	0.28	0.33	0.20	0.32	0.20
	(17.4)	(23.7)	(18.7)	(21.9)	(24.8)	(16.7)	(24.2)	(16.7)
5—6	0.20	0.40	0.26	0.32	0.33	0.25	0.34	0.24
	(16.7)	(28.6)	(20.6)	(24.2)	(24.8)	(20.0)	(25.4)	(19.4)
> 6	0.28	0.48	0.28	0.48	0.40	0.34	0.42	0.32
	(21.9)	(32.4)	(21.9)	(32.4)	(28.6)	(25.4)	(29.6)	(24.2)

$e^{(-1.266 - 0.200 - 0.106 - 0.117 - 0.210 - 0.125 - 0.313 - 0.232 + 0.105 + 0.150 - 0.053 + 0.059)} = e^{-2.31} = 0.10$ of being culled (equal to 9 % risk of culling). The odds ratio comparing these odds is 0.95/0.10 = 9.5. This means that cows with the former combination of variables are 9.5 times as likely to be culled as those with the latter combinations of variables. Similar comparisons can be made by forming such ratios between any two combination groups and using the denominator as the comparison level. In Table 4 the estimated odds (probabilities in parenthesis) of culling are given. When only main effects for a factor are included in the model, the odds for the levels of that factor are given, assuming zero effects for all other factors. When two factors exhibit an interaction effect the odds (probabilities) are given for combinations of factor levels, again assuming all other effects to be zero. Note, that odds ratios computed from Table 4 are stable over all levels of other factors.

The estimates of heritabilities and genetic correlations for culling and for milk production in the previous lactation are given in Table 5. All heritability estimates for culling in the various parity groups differ slightly, but significantly from zero. The genetic correlations between culling and milk production are negative.

Table 5. Estimates of heritabilities (h^2) for culling and for milk production in the previous lactation and genetic correlations (rg) between these.[a]

	Parity				
	1	2	3—4	5—6	> 6
Number of sires	221	175	238	75	32
Number of daughters per sire	72	65	61	56	56
Culling uncorrected h^2	0.035	0.024	0.023	0.042	0.085
— standard error of $\hat{h}^2$	0.009	0.009	0.008	0.018	0.039
Culling corrected h^2	0.097	0.064	0.050	0.079	0.143
Milk production h^2	—	0.220	0.229	0.169	0.055
— standard error of h^2	—	0.028	0.025	0.038	0.032
Genetic correlation rg	—	—0.676	—0.664	—0.300	—0.071
— standard error of rg	—	0.086	0.139	0.202	0.361

[a] The correction of the heritability estimates was made by the multiplication factor $P(1\text{-}P)/z^2$, where P was relative frequency of culled cows and z was ordinate at point P of the normal distribution.

DISCUSSION

The main advantage of using the health data recording system as a base for epidemiological studies is that the data is comprehensive including all dairy cow diseases in the country. The purposive selection procedure, utilizing milk registry farms and the farms where health registration was most complete, limits the possibility of generalising the results to other herds in Finland. On the other hand, the sample, which included 30 % of all dairy cows on the milk registry is sufficiently representative. Use of both conditions diagnosed by veterinary surgeons and farmers would make the data set more complete. After validation of the data it was decided that analyzing only treatment by veterinarians would yield more reliable information from which conclusions could be made. However, there still remains a variation among veterinary treatments. The ability of a dairyman to recognize a disease and to call a veterinarian varies from farm to farm. There may also be a variation among veterinarians in the treatment of cows for certain diseases or even in using certain diagnostic codes.

Thus, comparing disease incidence rates from different studies, one has to consider several factors. As discussed above, disease definition, diagnostic criteria and the source and method of collecting data can vary between studies. In addition, it is important to know which morbidity statistics were used and how they calculated. On the other hand, for statistical and genetic analysis, it is not a necessity that the recordings are absolutely complete as long as there are no systematic biases.

Overall 36.2 % of Ayrshire cows were treated at least once by a veterinarian in this study. *Solbu* (1982) reports that 39.0 % of cows were treated in Norway. The most common veterinary treatments are the same in Norway and in Sweden: mastitis, ketosis, parturient paresis and infertility (*Solbu* 1982, *Hennichs* 1985). However, incidence rates vary among these countries. Some of this variation may be explained by the factors discussed above. In particular this concerns mastitis. Using only the first treatment as a measure of lactation incidence rate, and specially excluding cases treated by telephone prescription, underestimate the real incidence rate. The factors affecting culling have been investigated using both reasons stated by farmers (*Burnside et al.* 1971, *Westell et al.* 1983) and by evaluating the role of indirect reasons for culling such as disease history and previous milk production (*Cobo-Abreau et al.* 1979a, *Martin et al.* 1982, *Dohoo & Martin* 1984). Our approach was to utilize a logistic regression model to examine the relationships, restricting the analysis to diseases occurring during the cows current lactation and using previous milk production.

In the current study the risk of culling increased with parity after the second parturition, and with increasing herd milk yield. Mastitis and parturient paresis had positive associations with culling, while ketosis and infertility had negative associations. The decreased risk of culling with infertility is in conflict with the reason for reproductive problems stated by farmers (*Burnside et al.* 1971). An obvious explanation is that the cows with infertility problems are better cows for milk production and they are not yet culled within 305 days post partum. In addition, the code infertility included several different diagnoses, which may have opposite effects.

Other common reasons for culling stated by farmers were low production, mastitis, udder problems and feet and leg problems (*Burnside et al.* 1971, *Westell et al.* 1982). Our observation on the increased risk of culling with increasing herd milk yield is not necessarily in conflict with culling for low production. Our finding may be interprepted as a higher selection pressure in the herds with higher milk yield. Investigations on a cow's disease history and the risk of being culled suppor the current findings by showing an increased risk of culling for cows with a history of mastitis, metritis and pneumonia or retained placenta (*Cobo-Abreau et al.* 1979b).*Dohoo & Martin* (1984) have also reported that subclinical mastitis, clinical diseases of the mammary gland, parturient paresis, respiratory disease and foot and leg problems contributed to an increased risk of culling. In addition, as here, clinical ketosis reduced the risk of culling, and disease of the reproductive tract did not contribute to an increased risk of culling.

There have been some attempts to identify genetic factors as indirect reasons for culling (*Parker et al.* 1969, *Westell et al.* 1982, *Van Doormal et al.* 1985). Conclusions from these studies are that heritabilities are small and it is difficult to consider culling reasons with present sire evaluation methods. Our approach was to estimate heritabilities for culling, in general, without any emphasis on particular reasons. The heretabilities in parity groups were small, but clearly different from zero. In Finland, where the progeny testing of bulls is based on large daughter groups (about 180 daughters per sire), even low heritability traits can be considered in breeding programs.

The main purpose of this study was not to estimate heritabilities for milk production. However, the sire and error variances must be obtained in order to estimate a genetic correlation, and thus heritabilities for milk production were also computed. The heritability estimates were very close to be previous estimates for Finnish Ayrshire cattle (*Lindström* 1969, *Lindström et al.* 1971, *Lintukangas* 1977). This indicates that the current data seem to be representative for the Finnish Ayrshire population.

The genetic correlations between culling and milk production were negative. The negative correlation implies that the daughters of genetically better sires for milk production have been culled less than the daughters of other sires.

The logit regression methodology used in this study seems to be an appropriate technique for analyzing a binary response factor. If the aim is to investigate the significance of diseases on culling, the risk factors, which are not of primary interest (e.g. parity, calving season and milk production) must be considered. In future studies, it would be reasonable to include the whole disease history of the cow in investigating the importance of diseases on culling. On the other hand, one has also to consider that reasons other than disease (e.g. economic) may affect the decision to cull.

ACKNOWLEDGEMENTS

The authors thank Pol. Lic. Juni Palmgren for advice on logistic regression, and the Agricultural Data Processing Centre for supplying computer facilities for statistical analysis.

REFERENCES

Blood, D. C., R. S. Morris, N. B. Williamson, C. M. Cannon & R. M. Cannon: A health program for commercial dairy herds. 1. Objectives and methods. Aust. vet. J. 1978, *54*, 207—215.

Burnside, E. B., S. B. Kowalchuk, D. B. Lambroughton & N. M. Mac Leod: Canadian dairy cow disposals. I. Differences between breeds, lactation numbers and seasons. Canad. J. Anim. Sci. 1971, *51*, 75—83.

Cobo-Abreau, R., S. W. Martin, J. B. Stone & R. A. Willoughby: The rates and patterns of survivorship and disease in a university dairy herd. Canad. vet. J. 1979a, *20*, 177—183.

Cobo-Abreau, R., S. W. Martin, R. A. Willoughby & J. B. Stone: The association between disease, production and culling in a university dairy herd. Canad. vet. J. 1979b, *20*, 191—195.

Cox, D. R.: Analysis of Binary Data. Chapman and Hall, London 1970.

Dempster, E. R. & I. M. Lerner: Heritability of threshold characters. Genetics 1950, *35*, 212—236.

Dohoo, I. R. & S. W. Martin: Disease, production and culling in Holstein-Friesian cows. V. Survivorship. Prev. Vet. Med. 1984, *2*, 771—784.

Erb, H. N. & S. W. Martin: Relationships between production and reproductive diseases in Holstein cows. Data. J. Dairy Sci. 1980, *63*, 1911—1917.

Feinberg, S. E.: The Analysis of Cross-classified Categorical Data. 2nd ed. MIT Press, Cambridge, Massachusets 1980.

Fleiss, J. L.: Statistical Methods for Rates and Proportions. 2nd ed. John Wiley & Sons, Inc., New York 1981.

Freund, R. J. & R. C. Littell: SAS for linear models. A guide to ANOVA and GLM procedures, SAS Institute, Inc., Cary, N.C. 1981.

Hennics, K.: Djursjukdata (Disease recording data). Husdjur 1985, 10, 11.

Lindström, U. B.: Genetic change in milk yield and fat percentage in artificially bred populations of Finnish dairy cattle. Acta Agr. Fenn. 1969, *114*, 128.

Lindström, U. B., K. Maijala & V. Vilva: Studies on A.I. dairy sire provings. II. Sire × region-interactions. Z. Tierzuchtg. Zuchtungsbiol. 1971, *88*, 1—11.

Lintukangas, S.: Erilaisten virhelähteiden ja erityisesti tuotostason ja maantieteellisen alueen vaikutus ay-sonnien jälkeläisarvosteluun. (Effects of region and herd milk level on dairy sire progeny testing results in Finnish Ayrshire). Ms. Sc. Thesis. Univ. of Helsinki, Dept. of Anim. Breed., Helsinki 1977, 114 pp.

Martin, S. W., S. A. Aziz, W. C. D. Sandals & R. A. Curtis: The association between clinical disease, production and culling of Holstein-Friesian cows. Canad. J. Anim. Sci. 1982, *62*, 633—640.

Parker, J. B., N. D. Bayley, M. H. Fohrman & R. D. Plowman: Factors influencing dairy cattle longevity. J. Dairy Sci. 1960, *43*, 401—409.

Ray, A. A.: SAS User's Guide: Statistics, SAS Institute Inc., Cary, N.C. 1982.

Robertson, A.: The sampling variance of the correlation coefficient. Biometrics 1959, *15*, 469—485.

Saloniemi, H.: Recording of health data and herd health management of dairy cattle in Finland. The 5th International Congress of Animal Hygiene. High Tatras, Czechoslovakia. Collected reports, 1982, 26—28.

Schwabe, C. W.: The current epidemiological revolution in veterinary medicine. Part I. Prev. Vet. Med. 1982, *1*, 5—15.

Schwabe, C. W., H. P. Riemann & C. E. Franti: Epidemiology in Veterinary Practice. Lea & Febiger, Philadelphia, PA 1977.

Solbu, H.: Disease recording in Norwegian dairy cattle. I. Disease incidence and non-genetic effects on mastitis, ketosis, and milk fever. Z. Tierz. Zuchtungsbiol. 1983, *100*, 139—156.

Swiger, L. A., W. R. Harwey, D. O. Ewerson & K. E. Gregory: The variance on intraclass correlation involving groups with one observation. Biometrics 1964, *20, 818—826.*

Teittinen, H.: Kuukausiraporttien ja terveystarkkailutietojen vertailua (The comparison of the data of health recording system and official statistitcs). Suom. Eläinlääk.-L. 1985, *91*, 384—387.

Van Doormaal, B. J., L. R. Schaeffer & B. W. Kennedy: Estimation of genetic parameters for stayability in Canadian Holsteins. J. Dairy Sci. 1985, *68*, 1763—1769.

Westell, R. A., E. B. Burnsnde & L. R. Schaeffer: Evaluation of Canadian Holstein-Friesian dairy sires on disposal reasons for their daughters. J. Dairy Sci. 1982, *65*, 2366—2372.

SAMMANDRAG

En epidemiologisk och genetisk undersökning av sjukdomsdata från finsk Ayrshire boskap. I. Dataset, sjukdomsfrekvens och slakt.

Den epidemiologiska och genetiska variationen av de mest allmänna mjölkboskapssjukdomarna har undersökts. I denna publikation beskrevs dataset, lactation incidence rate (LIR) och orsak till slakt. Materialet innehåller laktationsresultat från 73368 finska Ayrshire kor. Varje ko observerades från 2 dagar före till 305 dagar efter kalvningen. LIR (%) för de mest allmänna sjukdomarna var ovulationstörningar 7.0, ketos 6.0, akut mastit 5.4, brunstsvaghet 5.2, kvarbliven efterbörd 5.5, paresis puerperalis 3.8 och spensjukdomar 2.6. Inverkan av möjliga faktorer på slakt undersöktes med multipel logitisk regression. Modellen prognostiserar log odds för slakt som additiv funktion av de förklarande faktorerna. Odds ratio beräknades av estimerade odds för att undersöka relaterande risken mellan olika kombinationer av förklarande faktorer. Slaktrisken ökar med ökat antal laktationsperioder efter den andra laktationen och med ökande besättningsmedelproduktion. Mastit och pares har ett positivt samband med slakt, medan ketos och infertilitet har ett negativt samband. Ärftligheten för slaktrisken i olika laktationsperioder var från 2 % till 9 % i den binomiala skalan motsvarande från 5 % till 14 % i den normala skalan. Genetisk korrelation mellan slakt och tidigare mjölkproduktion var negativ.

(Received February 6, 1986).

Reprints may be requested from: Yrjö Gröhn, the College of Veterinary Medicine, P. O. Box 6, 00551 Helsinki, Finland.