Estimating genetic parameters of feed efficiency traits in American mink

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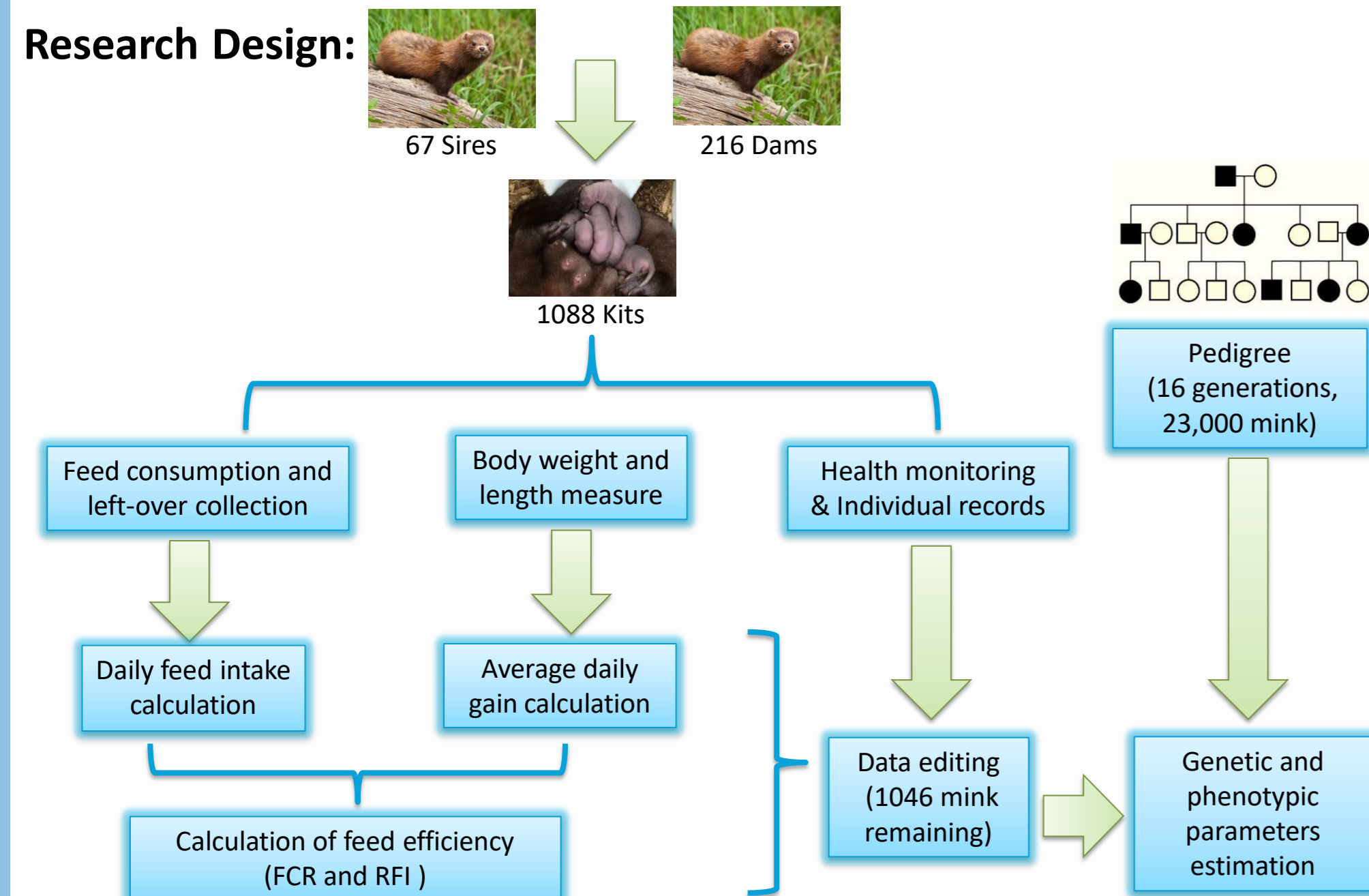Department of Animal Science and Aquaculture, Dalhousie University, Truro, Nova Scotia, B2N 5E3, Canada

Introduction

✓ The American mink (*Neovison vison*) is the most widespread animal used in fur production [1].

✓ Feed cost is the major input cost in the mink industry. Improvement of feed efficiency is necessary for mink farmers, but little is known about the genetic parameters of feed efficiency in mink.

Objective

✓ To estimate the heritability, phenotypic and genetic correlations for feed efficiency traits.

Materials and Methods

Research Design:

67 Sires   216 Dams

1088 Kits

Feed consumption and left-over collection
Body weight and length measure
Health monitoring & Individual records
Pedigree (16 generations, 23,000 mink)

Daily feed intake calculation
Average daily gain calculation

Calculation of feed efficiency (FCR and RFI)

Data editing (1046 mink remaining)

Genetic and phenotypic parameters estimation

Collection Details:

✓ 1,088 American mink from the Canadian Centre for Fur animal Research (CCFAR) at Dalhousie Faculty of Agriculture (Truro, NS, Canada) were used in this study.

✓ Daily feed intake (DFI) and final body weight (FBW) were recorded from August 1st to November 14th in both 2018 and 2019.

Feed Efficiency Measures:

✓ Average Daily Gain (ADG) = $\frac{\text{Finish weight} - \text{Start weight}}{\text{Age (days)}}$

✓ Feed Conversion Ratio (FCR) = $\frac{\text{Feed intake}}{\text{Average daily gain}}$

✓ Residual Feed Intake (RFI) = $DFI_{actual} - DFI_{expected}$

Data Analysis:

✓ Genetic and phenotypic parameters were estimated via bivariate models using ASReml-R version 4 [2].

Materials and Methods

Figure 1. Daily collection of feed left-over.

Figure 2. Weighing animals every three weeks.

Results

Table 1. Descriptive statistics of the studied traits.

Traits	Number	Mean±SE	Range
FBW, kg	1046	2.11±0.02	1.00-3.86
ADG, g/d	1046	8.31±0.11	1.26-19.66
DFI, g	1046	226.20±1.73	116.6-365.3
FCR	1046	31.58±0.39	10.88-128.26
RFI, g/d	1046	0.07±1.11	-115.92-177.08

SE = Standard Error.

Table 2. Fixed and random effects of the studied traits analyzed by univariate models.

Traits	Fixed Effects			Random Effect
	Sex	Year	Color type	Dam
FBW	*	*	*	*
ADG	*	NS	NS	*
DFI	*	*	NS	*
FCR	*	*	NS	NS
RFI	*	*	NS	*

NS = Non-significant. * P < 0.05.

Table 3. Estimates of heritabilities (diagonal), genetic correlations (above diagonal), and phenotypic correlations (below diagonal) and their SE for the studied traits in American mink.

	FBW	ADG	DFI	FCR	RFI
FBW	0.41±0.10	0.94±0.03	0.78±0.10	-0.70±0.10	0.16 ± 0.24
ADG	0.88±0.01	0.33±0.14	0.69±0.13	-0.86±0.05	0.04±0.26
DFI	0.55±0.02	0.48±0.03	0.37±0.11	-0.13±0.17	0.74±0.11
FCR	-0.56±0.02	-0.70±0.01	-0.09±0.04	0.24±0.09	0.67±0.14
RFI	-0.12±0.04	-0.17±0.03	0.75±0.01	0.39±0.03	0.22±0.09

Discussion

✓ The heritabilities were moderate for both FCR (0.24±0.09) and RFI (0.22±0.09) ➜ It is possible improve them in breeding programs.

✓ RFI had low genetic correlations with ADG (0.04±0.26) and FBW (0.16±0.24) ➜ Selection based on RFI had no adverse effects on animal size and growth rate. Our results were in agreement with the results of Madsen et al. [3] that reported no unfavorable genetic correlations between RFI and BW in mink.

✓ High genetic correlation between RFI and DFI (0.74±0.11) ➜ Selection for lower RFI will reduce feed intake.

Future Direction

✓ The results suggested that RFI can be implemented in genetic/genomic selection programs to reduce feed intake in the mink production system.

✓ These are the preliminary results; and other data will be added to this data set in order to perform further comprehensive analyses of estimating genetic parameters of feed efficiency traits in American mink.

Acknowledgments

References

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3. Madsen, M. D., et al. "Combined analysis of group recorded feed intake and individually recorded body weight and litter size in mink." *animal* (2020): 1-9.

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