The genetics of host resistance to gastrointestinal parasites in Merino sheep

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Introduction

- Breeding for host resistance to gastrointestinal parasites has become the method of choice in many sheep industries
- Faecal egg count (FEC) is the common indicator of resistance
- Diarrhoea could be another indicator of intestinal parasitism
- This study investigated the genetics of these indicators of parasitism, plus bodyweight, over the first 400d of a lamb's life

Faecal egg count

- Faecal egg count (FEC) measured using the modified McMaster method
- Cube-root transformed data used in all analyses

Dag score

- Dags scored visually
- 0 (no dags) to 5 (large amount of dags) scale used

Faecal consistency score

- Dung pellets scored on a 1 (hard pellets) to 5 (watery dung) scale
- Measurements taken at the same time as FEC

Trial design

- 1,200 lambs, from 37 sires, measured at two sites
- Measurements taken eight times from weaning (100d of age) to hogget age (400d) approximately 1 month apart

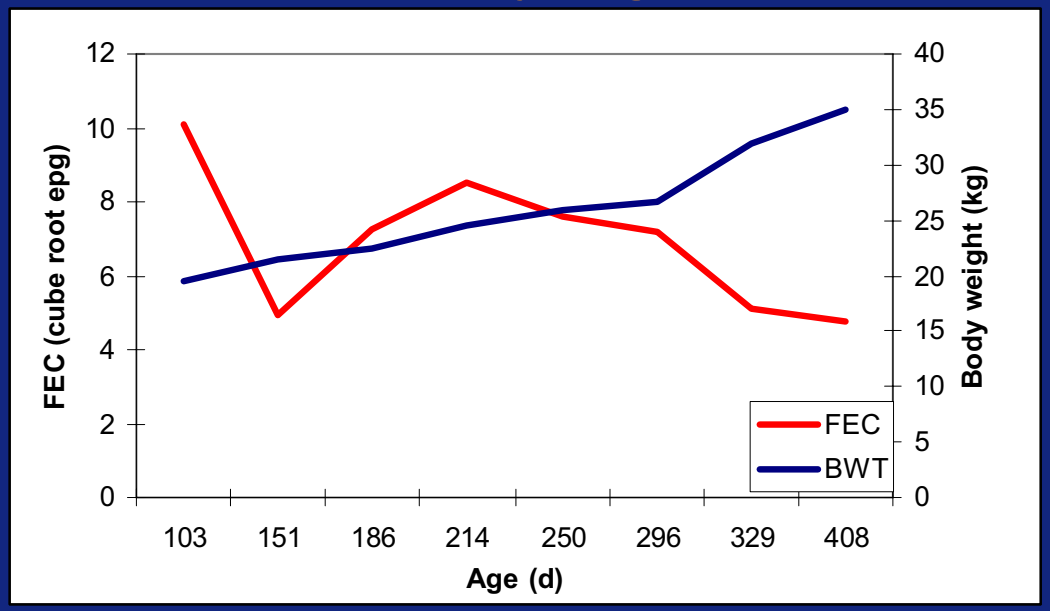
Overall models

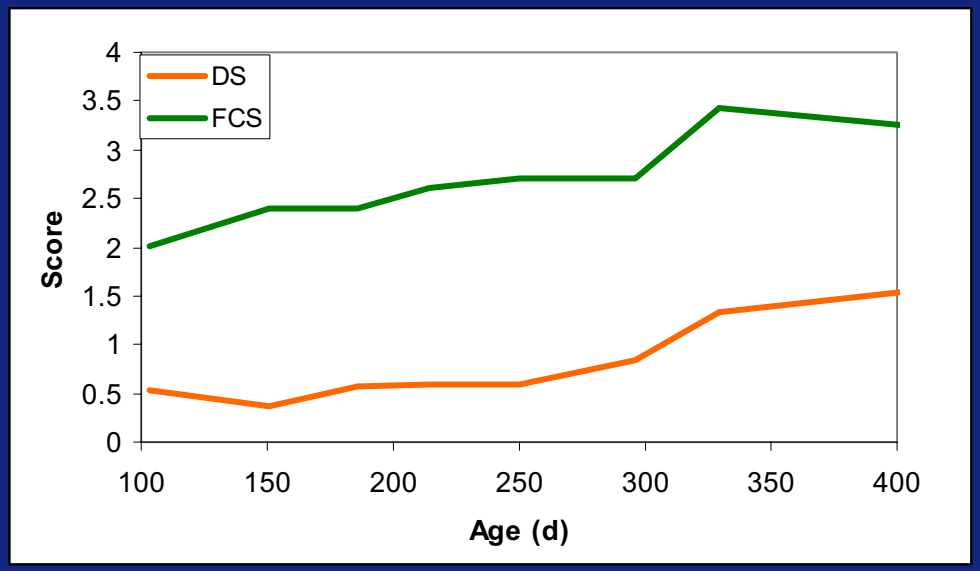
- All four traits analysed by repeatability sire model using ASREML
- Fixed effects of year, site, birth type, sex, recording time fitted plus age (cubic polynomial)
- Random effects of sire and lamb fitted
- Additive variance calculated as 4xsire variance
- Repeatability and heritability estimated

Random regression models

- Data standardised to have a mean of 0 and variance of 1 within contemporary groups (site/year/recording time combination)
- Sire values regressed on age (linear) or age and age^2 (quadratic) models
- Covariance between random regression terms also fitted (1 for linear and 3 for quadratic models)

Trait means by age of lamb





Basic statistics and ANOVA summary

	Faecal egg count	Dag score	Faecal consistency score	Body weight
No.	8,170	8,438	8,162	8,454
Mean	$7.1epg^{0.33}$	0.8	2.6	25.5kg
SD	$4.4epg^{0.33}$	1.2	0.96	6.5kg
Site/year	***	***	***	***
Sex	***	NS	NS	***
Birth type	NS	***	***	***
Recording time	***	***	***	***
Age	***	***	***	***

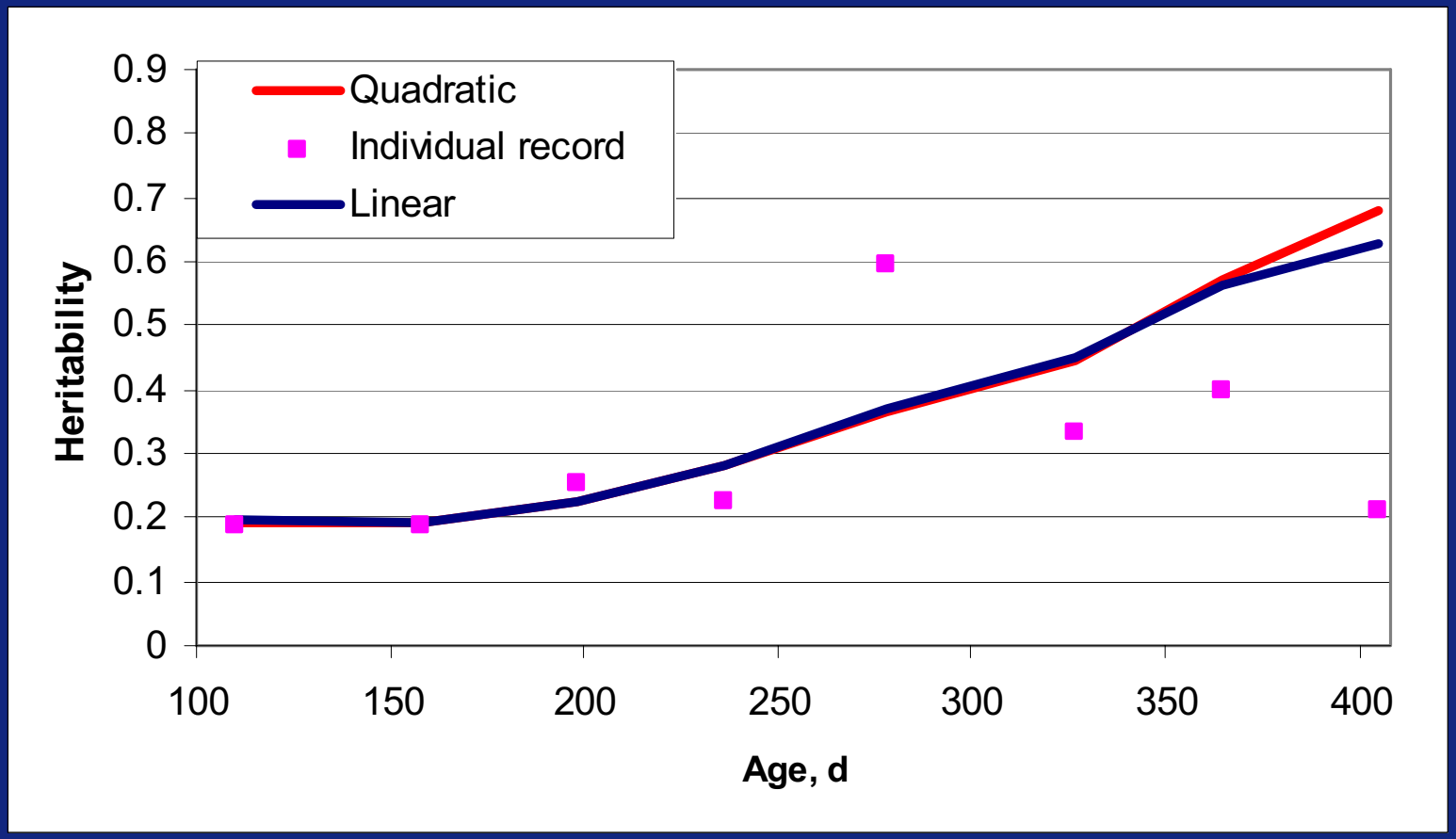
Overall heritabilities and correlations

	FEC	DS	FCS	BWT
Fecal egg count (FEC)	**0.28[1]±0.07** **0.22[2]±0.02**	0.10[3]±0.22	-0.01±0.20	-0.32±0.19
Dag score (DS)	0.02[4]±0.02	**0.11±0.04** **0.25±0.01**	0.63±0.14	0.27±0.23
Fecal consistency score (FCS)	-0.03±0.01	0.33±0.01	**0.12±0.04** **0.12±0.01**	0.43±0.20
Body weight (BWT)	-0.05±0.02	-0.09±0.02	0.09±0.02	**0.23±0.07** **0.57±0.01**

[1]= Heritability. [2]= Repeatability. [3]= Genetic correlations above diagonal.

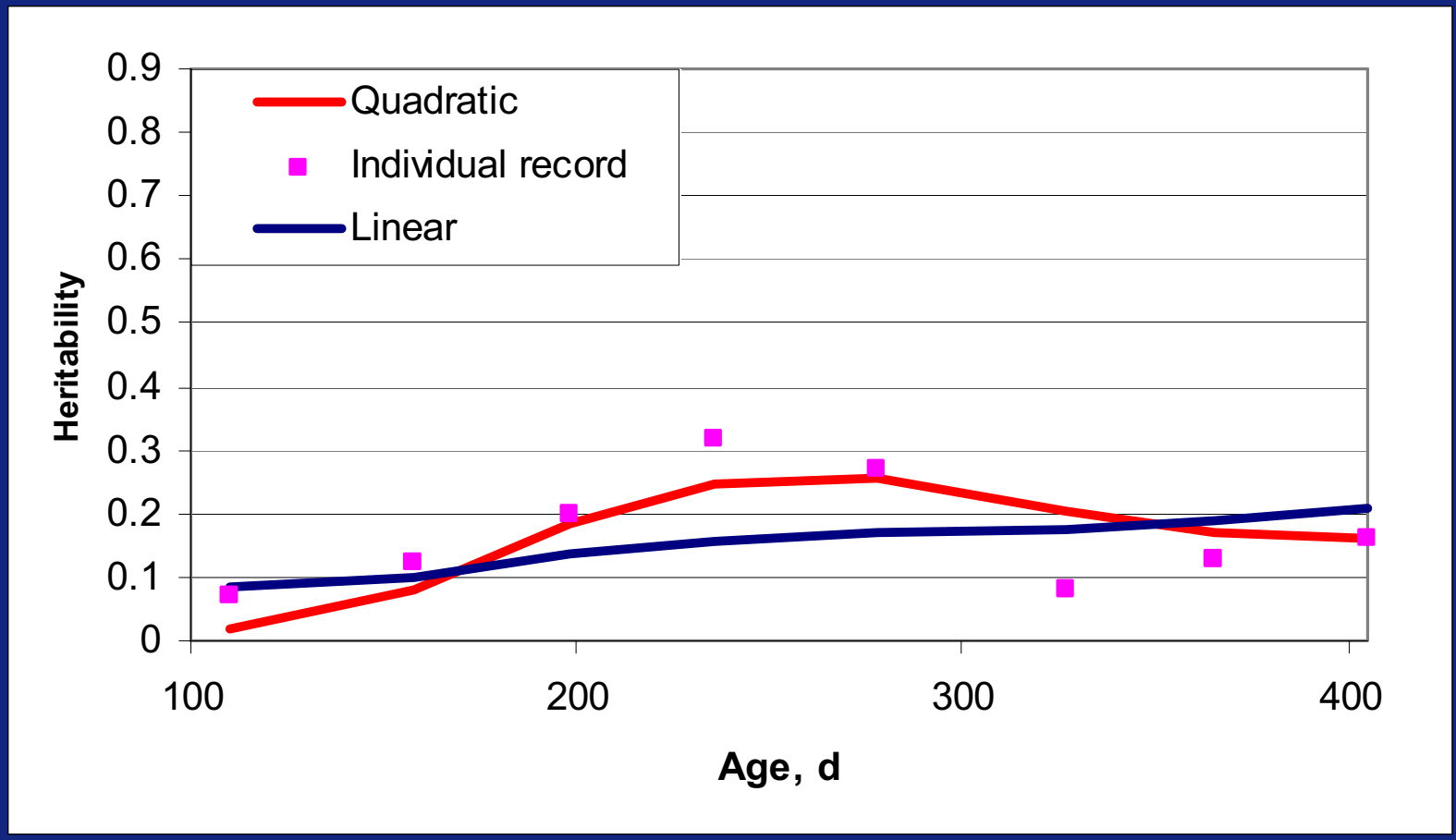
[4]= Phenotypic correlations below diagonal

Heritability of faecal egg count by age of lamb



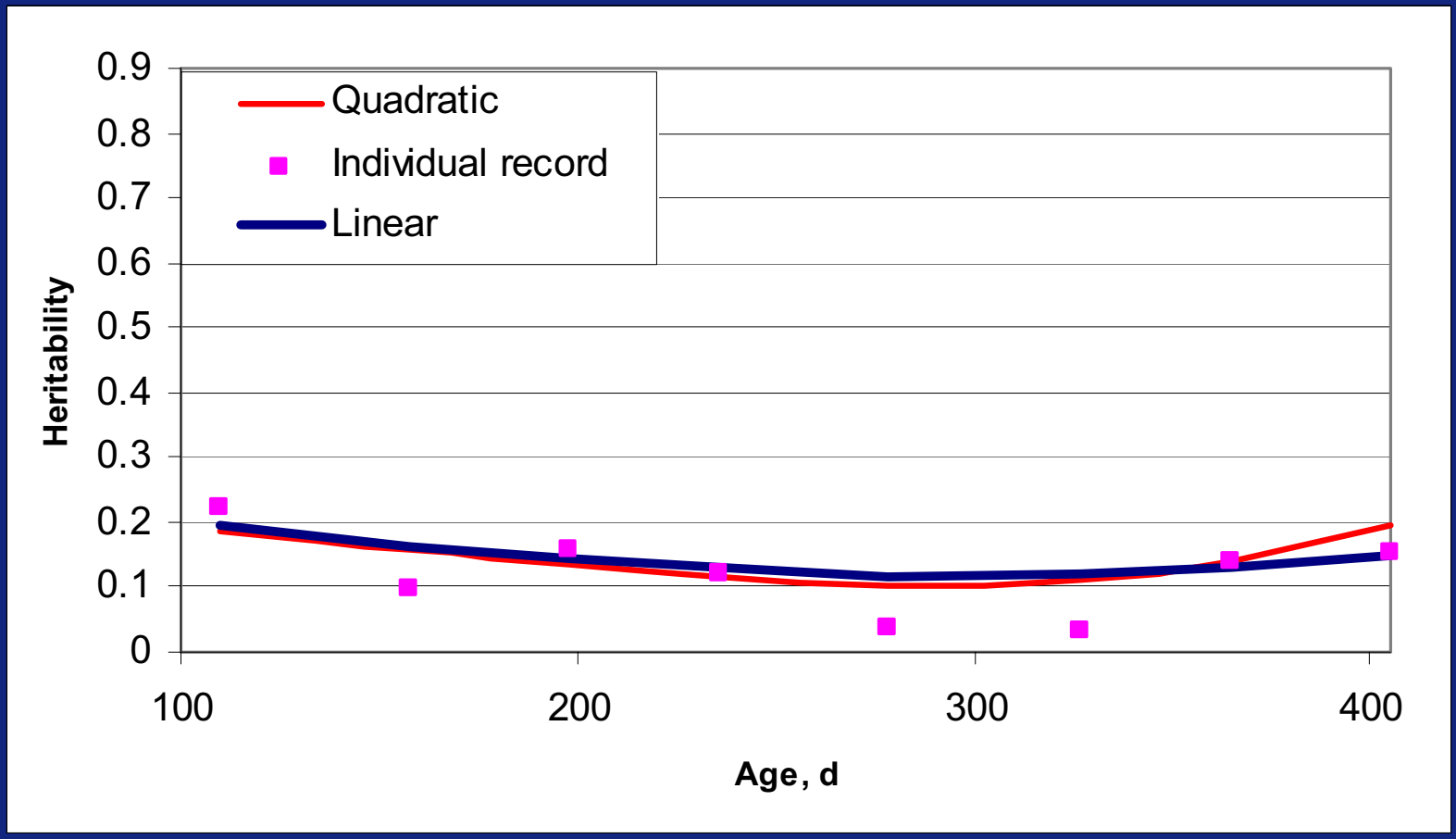
SE of random regression heritabilities 0.06 at 110 d, 0.07 at 250 d, and 0.13 at 405d

Heritability of dag score by age of lamb



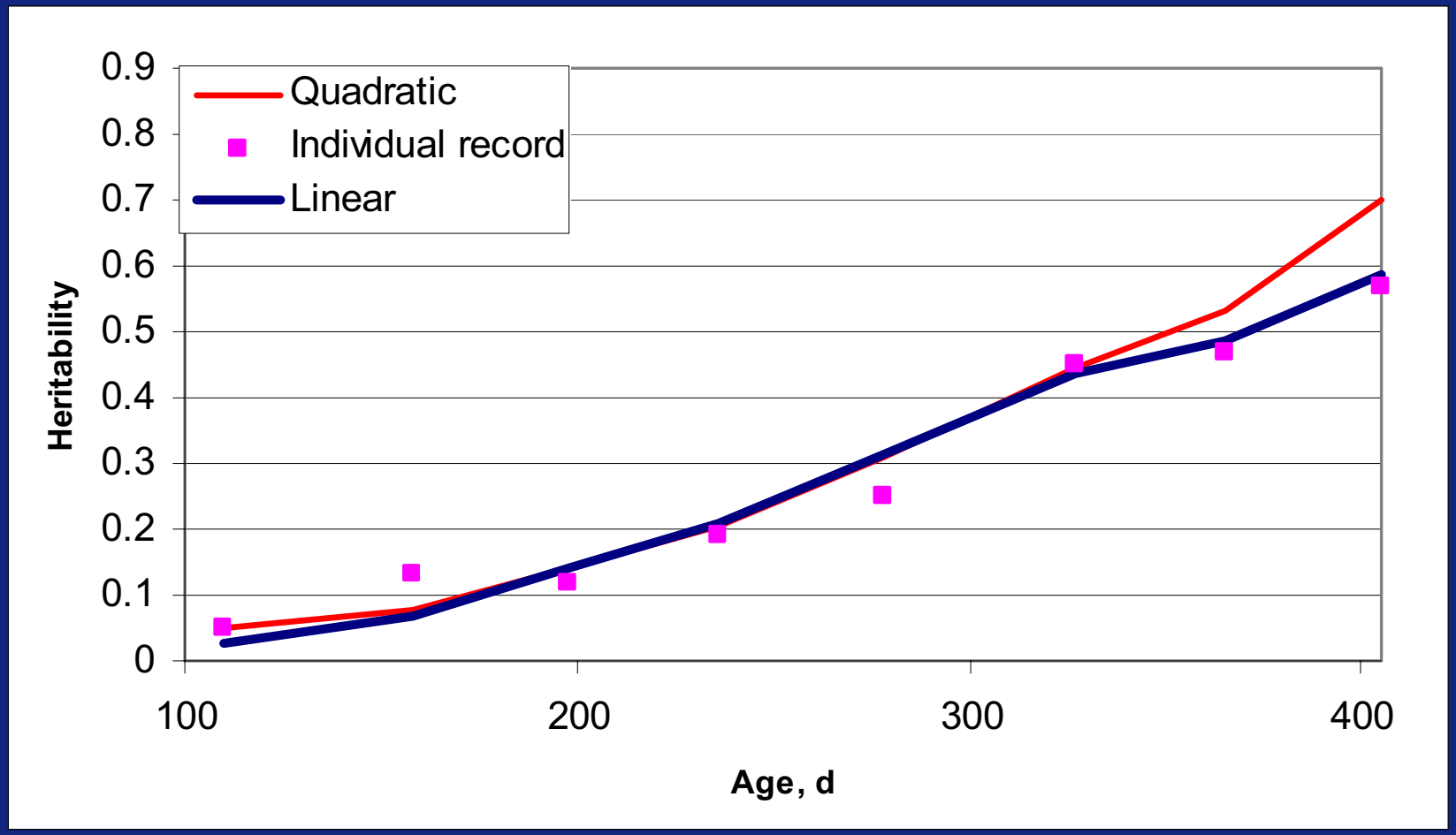
SE of random regression heritabilities 0.04 at 110 d, 0.04 at 250 d, and 0.07 at 405d

Heritability of faecal consistency score by age of lamb



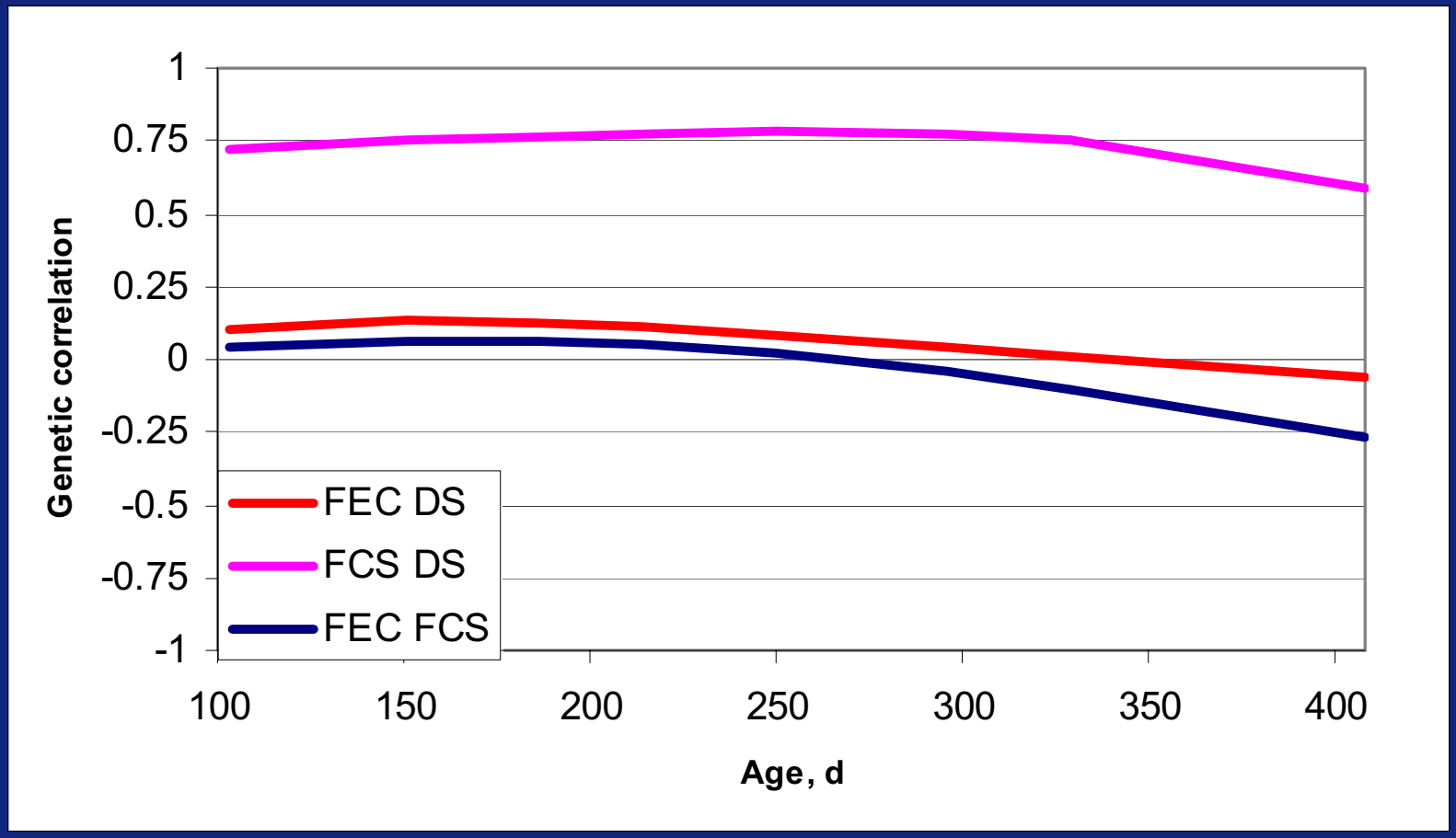
SE of random regression heritabilities 0.06 at 110 d, 0.04 at 250 d, and 0.05 at 405d

Heritability of body weight by age of lamb



SE of random regression heritabilities 0.04 at 110 d, 0.08 at 250 d, and 0.15 at 405d

Genetic correlations by age of lamb



SE of correlations between FEC and DS 0.26 at 110 d, 0.24 at 250 d, and 0.26 at 405d.
SE of correlations between FCS and DS 0.16 at 110 d, 0.12 at 250 d, and 0.26 at 405d.
SE of correlations between FEC and FCS 0.29 at 110 d, 0.25 at 250 d, and 0.24 at 405d.

Conclusions

- Heritability of FEC increases with age of lamb
- Dag score and faecal consistency score have low heritability
- Dag score has a higher heritability at intermediate ages
- Dag score and faecal consistency score closely related
- FEC not related to dag score or faecal consistency score

Acknowledgements

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