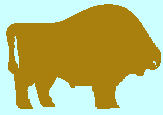


# Risk of scrapie: the impact of *PrP* genotype, sheep breed and scrapie strain



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## 1. Introduction

Scrapie is an infectious disease of sheep, but one in which genetic susceptibility also plays a strong role. This is the basis of several national schemes within the EU which aim to breed for resistance to scrapie. Genetic susceptibility is suggested to vary according to the strain of scrapie agent present, and according to sheep breed. Breed effects may be conferred by two factors: the varying frequencies of *PrP* genotypes in different breeds; and breed differences in the actual susceptibility of individual *PrP* genotypes. Here we present the results of three investigations into the effects of strain and breed on susceptibility to scrapie.

## 3. Genotype susceptibility in certain breeds of sheep

The risk of scrapie in different genotypes in 18 UK sheep breeds was calculated according to Baylis et al., (2004). As shown in figure 1, there was no evidence that individual *PrP* genotypes confer different levels of susceptibility within different breeds. However, the results were confounded by very wide confidence intervals and no definite conclusions can be drawn from them.

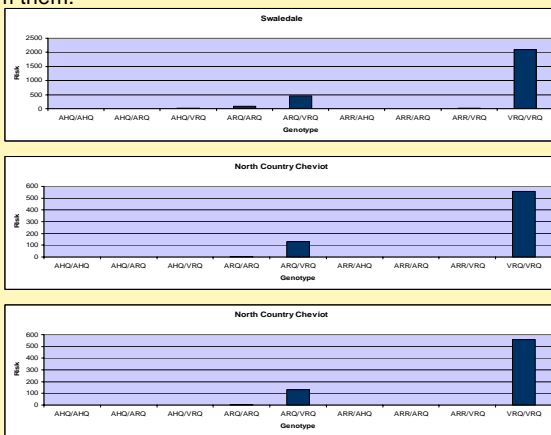


Figure 1. Risk of scrapie in individual genotypes in three sheep breeds

## 5. Breed-level susceptibility

A measure of breed-level susceptibility was defined based on the relative frequency of genotypes in the flock, and the risk of scrapie in those genotypes. When this was compared with the proportion of farms in different breeds reporting scrapie in the 2002 postal survey, a significant association ( $p < 0.05$ ) was found (figure 4). This shows that the frequency of at-risk *PrP* genotypes in breeds can be used to explain variation in the prevalence of scrapie amongst breeds.

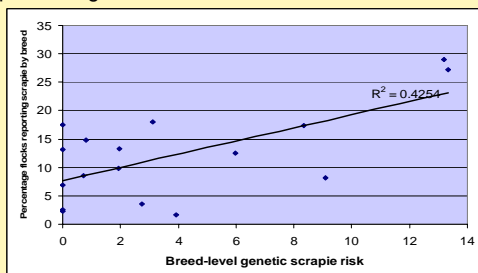


Figure 4. The relationship between the proportion of flocks of each breed reporting scrapie in the 2002 Postal Survey and a measure of the risk of disease, adjusting for breed.

## 2. Materials

Data used were derived from four sources:

**Scrapie case data:** data on reported cases of scrapie in GB was obtained from the Scrapie Notifications Database (SND).

**Genotype data:** the National Scrapie Plan for Great Britain (NSP) provided data on the frequencies of *PrP* genotypes within breeds in the national sheep flock.

**Breed numbers:** data on sheep numbers for each breed in Great Britain were obtained from the Pollott survey (Pollott, 2004).

**Flock level scrapie:** The frequency of flock-level scrapie infection in breeds was estimated from the results of the 2002 Anonymous Postal Survey of Great Britain (see McIntyre et al., 2006).

## 4. Genotypes of scrapie case within flocks and breeds

A descriptive investigation was carried out on flocks with more than 10 scrapie cases recorded within the SND.

For flocks in which scrapie was reported in several different breeds, cases occurred in similar genotypes, regardless of breed (figure 2).

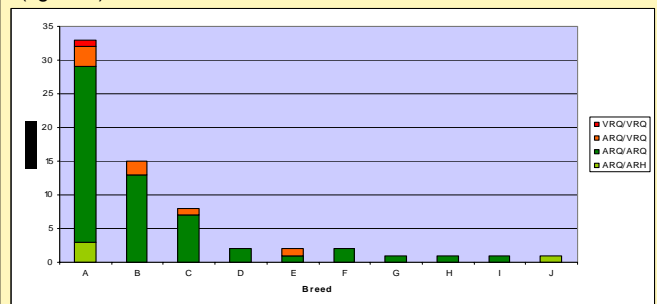


Figure 2. Genotypes of scrapie cases in a flock where scrapie occurred in 10 breeds.

However, breeds in which scrapie had been reported in several flocks did not always show a consistent distribution of *PrP* genotypes in their cases. This was most noticeable in the Swaledale breed (figure 3), where flocks 1 and 2 showed considerably more ARQ-type scrapie. [Note, flocks 1 & 2 were from an isolated location.]

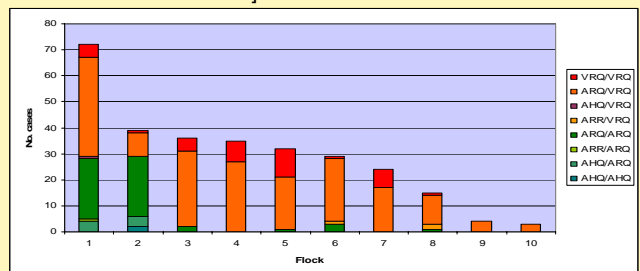


Figure 3. Genotype distribution of scrapie cases in Swaledale flocks.

These results imply that scrapie strains circulating within various flocks may play a more important role than breed in determining the level of susceptibility associated with specific genotypes.

## 6. Conclusions

Taken together, these investigations indicate that differences amongst breeds in the relative susceptibility of specific *PrP* genotypes play a less important role in determining genetic susceptibility than either differences in the relative frequencies of genotypes amongst breeds, or the strain of scrapie agent.

**Acknowledgements** Thanks to NSPAC and the VLA for providing data, and the BBSRC for Ms. Trewby's summer student bursary. Drs. McIntyre & Gubbins are supported by BBSRC core funding grant 1055.

**References** Baylis et al. (2004), J. Gen. Virol., 85, 2735-2740.

McIntyre et al. (2006), BMC Vet. Research, 2, 25.

Pollott (2004), see

[www.defra.gov.uk/animalh/bse/othertses/scrapie/nsp/publicatsrpts/](http://www.defra.gov.uk/animalh/bse/othertses/scrapie/nsp/publicatsrpts/)