

No temporal trends in the prevalence of atypical scrapie in British sheep



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Summary

- Samples from abattoir & fallen stock surveys are used to identify cases of both classical & atypical scrapie.
- By the end of 2006, 147 atypical positives had been identified from 179162 sheep sampled. These data were used to assess temporal trends in atypical scrapie in sheep in Great Britain between 2002 & 2006.
- There were no significant temporal trends in the prevalence of atypical scrapie in either survey.
- This adds to evidence that this atypical form of scrapie may be a sporadic condition or, if it is infectious, that the force of infection is very low.

Introduction

Atypical scrapie, including Nor98, is recognized as distinct from classical scrapie in terms both of neuropathology and patterns of genetic susceptibility.

Active surveillance using abattoir & fallen stock surveys in GB, allowed the investigation of patterns in the detectable prevalence of infection; examining changes in overall prevalence, then stratifying by sampling year & the three main codons (136, 154 & 171) associated with classical scrapie.

Evidence of temporal trends in the results would suggest either:

- changes in the genotype profile of the GB national flock, the denominator, as a result of selective breeding programmes under the National Scrapie Plan for Great Britain (NSP); or
- changes in the number of cases, the numerator, due to ongoing transmission.

Methods

Annual prevalence was the number of atypical scrapie positives/number of samples tested (Fig. 1). 95% confidence intervals (CI) were calculated using the Wilson score interval.

Differences in prevalence within & between surveys were assessed using chi-squared or Fisher exact tests.

Further analyses used generalised linear models with binomial errors and logit link function to assess different aspects of the surveillance results:

- To examine whether temporal trends in prevalence differed by survey.
- To examine differences in prevalence amongst genotypes & whether these differed between surveys.
- To examine temporal trends in prevalence in different genotypes for the abattoir survey alone (fallen stock survey sample sizes were too small).

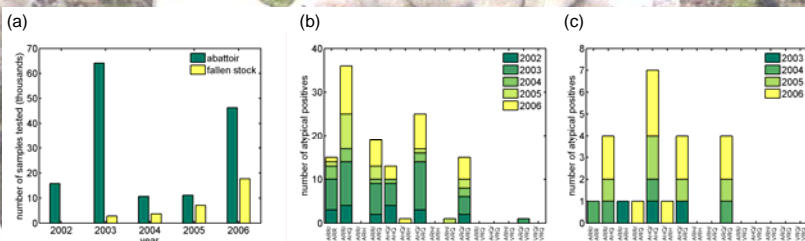


Fig. 1 (a) Number of samples tested and (b,c) PrP genotype distribution of samples which were positive for atypical scrapie each year in: (b) abattoir; and (c) fallen stock surveys.

Results

There was no significant difference ($P=0.59$) between surveys in the estimated prevalence of atypical scrapie for all years combined (abattoir survey, 0.09%; fallen stock survey, 0.07%), or annually (2003, $P=0.46$; 2004, $P=0.99$; 2005, $P=0.23$; and 2006, $P=0.69$) (Fig. 2).

Examining other aspects of surveillance results:

- There was no significant temporal trend in the prevalence of atypical scrapie ($P=0.69$), nor any difference in prevalence between surveys ($P=0.51$).
- There were no significant differences in prevalence estimates within PrP genotypes for the two surveys ($P=0.46$).
- There was no significant effect of year ($P=0.32$), but was a significant effect of genotype ($P<0.001$, Table 1) on abattoir survey results: prevalence of atypical scrapie in each genotype did not change over time.

Discussion

Although atypical scrapie prevalence did not change over time within genotypes, the overall prevalence could vary if the frequency of PrP genotypes were to change, e.g. due to selective breeding in NSP.

However, there has been little effect of the NSP on AHQ: the frequency of this allele in ram lambs genotyped for the NSP has remained constant¹. Moreover, the frequency of the ARQ allele in ram lambs has changed only slightly¹. These small changes help explain why overall prevalence has not changed significantly over time.

The differences in prevalence amongst genotypes (Fig. 1, Table 1) is similar to previous studies of atypical scrapie, which also identified an increased risk associated with the AHQ allele².

Data to examine risk associated with the polymorphism at codon 141 were not collected (they will be in future); this could potentially highlight differences in prevalence in these genotypes².

Conclusions

This analysis suggested the prevalence of atypical scrapie did not change significantly between 2002 and 2006, nor did it differ significantly between the abattoir and fallen stock surveys, unlike for classical scrapie.

Recent experimental work has demonstrated the transmissibility of atypical scrapie³, and examination of demographic factors and trading patterns suggested transmission could be occurring slowly⁴. By contrast, a case-control study of Nor98 found no risk factors to indicate transmission between flocks⁵, suggesting a sporadic nature.

Taken together, these results suggest that atypical scrapie may be a sporadic condition or, if it is infectious, the force of infection is very low.

Fig. 2 Estimated prevalence of atypical scrapie in AS & FS. Error bars show 95% confidence limits.

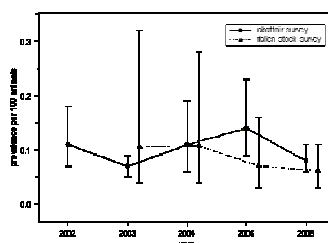


Table 1 Genotype-specific risk of atypical scrapie being detected in AS. (Odds ratios in bold differ significantly ($P<0.05$) from baseline (AHQ/AHQ).

PrP genotype	estimate	95% confidence limits	
		lower	upper
ARRARR	0.07	0.03	0.15
ARRAHQ	0.47	0.21	1.06
ARRARH	0	-	-
ARRARQ	0.07	0.03	0.15
AHQ/AHQ ²	1	-	-
AHQ/ARH	0.36	0.03	0.64
AHQ/ARQ	0.39	0.17	0.92
ARH/ARH	0	-	-
ARH/ARQ	0.5	0.04	0.7
ARQ/ARQ	0.13	0.05	0.33
ARV/VRQ ²	0	-	-
AHQ/VRQ ²	0	-	-
ARH/VRQ ²	0	-	-
ARQ/VRQ ²	0.06	0	0.84
VRQ/VRQ ²	0	-	-

¹Warner *et al.* (2006) *Vet. Rec.* 159:473-479; ²Moum *et al.* (2005) *JGV*, 86:231-235; ³Simmons *et al.* (2007) *BMC Vet. Res.* 3:20; ⁴Green *et al.* (2006) *JGV* 88:3486-3492; ⁵Hopp *et al.* (2006) *JGV* 87:3729-3736