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Equine grass sickness – the geochemical connection

A new study uses the British Geological Survey's geochemical map to investigate whether minerals in the environment are a factor in this predominantly fatal neurodegenerative disease of horses

EQUINE GRASS SICKNESS was first recorded in army horses at Barry Camp, Angus, in the early 1900s after which outbreaks were described across northeast Scotland before spreading to England and Wales. Great Britain continues to have the highest reported prevalence worldwide, with a high proportion of cases in Scotland.

The common clinical signs relate to gastrointestinal paralysis and include abdominal pain, difficulty swallowing and weight loss. The precise cause remains unknown, but there is evidence to suggest that it may be a toxico-infectious form of botulism, with *Clostridium botulinum* producing neurotoxins locally within the gastrointestinal tract.

Certain 'trigger factors' may also be required to induce disease. These remain largely unidentified, but there is strong evidence implicating an environmental agent encountered while grazing, and low dietary intake of essential elements has been postulated as a risk factor.

The Royal (Dick) School of Veterinary Studies (RDSVS), the British Geological Survey (BGS) and the James Hutton Institute (JHI) have collaborated to investigate the potential association between geochemical parameters in the soil/environment and the distribution of EGS cases in eastern Scotland. This investigation was conducted as a retrospective case-control study using data collected between 01/01/1990

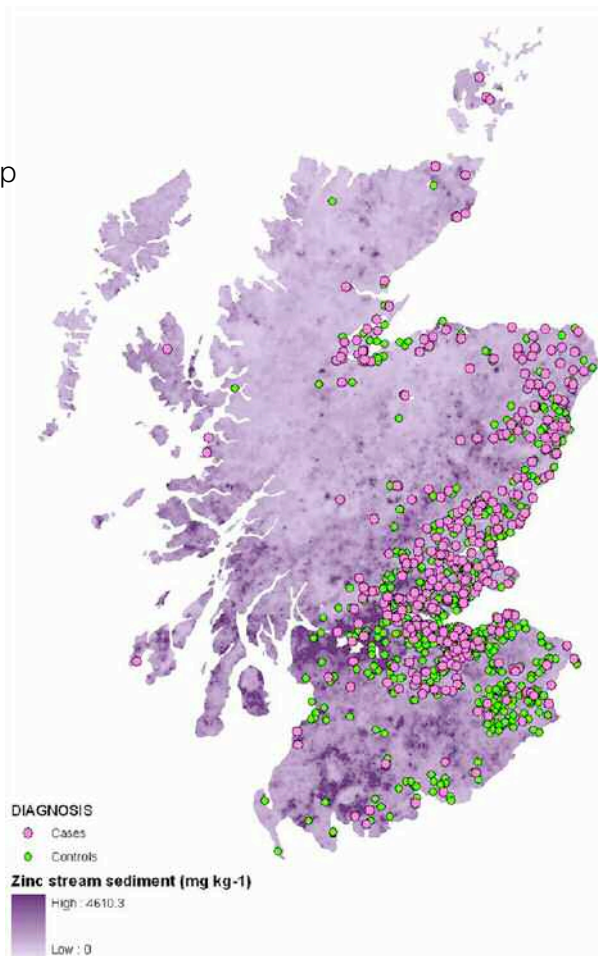
and 01/06/2006. A case was determined to be any horse or pony diagnosed with EGS by a clinician at the RDSVS. Two time-matched controls were obtained for each case, and a complete spatially referenced database of locations was produced for 455 cases. This involved 1365 animals in total – the largest case-control study of EGS undertaken to date (see map).

A range of trace elements, most with known biological function, was collated from two geochemical datasets. Interpolated maps (based on a 250 m grid) of fine fraction (< 150 µm) first and second order stream sediment total element concentrations were provided by the BGS Geochemical Baseline Survey of the Environment (G-BASE) project, which is the national geochemical survey of the UK. The James Hutton Institute (JHI), formerly, the Macaulay Land Use Research Institute, also provided maps of averaged values of a range of trace elements determined by Inductively Coupled Plasma – Atomic Emission Spectrometry or Graphite Furnace Atomic Absorption Spectrometry from a wide range of individual soil profiles collected from throughout Scotland.

Statistically significant univariate associations were found for a number of geochemical parameters in both datasets. For example, lower concentrations of chromium, lead and zinc in the BGS stream sediment dataset ($P < 0.003$) and the JHI soil dataset ($P < 0.001$), and higher concentrations of titanium in the BGS sediment dataset ($P < 0.003$) and JHI soil dataset ($P < 0.001$) were associated with an increased risk of EGS.

Further analysis is ongoing to establish a final multivariable model to determine which factors remain associated with EGS occurrence after accounting for other variables. It is hoped this study will identify geochemical parameters in soils that warrant further investigation at the level of the horse-grass-soil relationship.

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Map showing the location of the equine grass sickness cases (n=455) and controls (n=910) in eastern Scotland and concentrations of zinc in the environment based on the BGS G-BASE stream sediment dataset for Scotland.

Map source: 2001 Census Output Area Boundaries. Crown copyright 2003, reproduced with the permission of the Controller of HMSO. Geochemical data © BGS, NERC



A pony exhibiting the classical clinical signs of equine grass sickness with severe weight loss, a 'tucked-up' abdominal appearance, 'elephant-on-a-tub' stance and depression

The association between the distribution of cases of equine grass sickness in Eastern Scotland and environmental geochemical parameters

Wylie C.E.¹, Shaw D.J.², Fordyce F.M.³, Lilly, A.⁴ and McGorum B.C.²

(1) Animal Health Trust, Lanwades Park, Kentford, Newmarket, Suffolk CB8 7UU, UK

(2) Royal (Dick) School of Veterinary Studies & The Roslin Institute, Easter Bush Veterinary Centre, The University of Edinburgh, Roslin EH25 9RG, UK

(3) British Geological Survey, West Mains Road, Edinburgh EH9 3LA, UK

(4) James Hutton Institute, Craigiebuckler, Aberdeen AB15 8QH, UK