



OPEN ACCESS

FOOD/FARMED ANIMALS

# Prevalence of gastrointestinal parasites in a yak herd in Nepal

Joseph William Angell,<sup>1,2</sup> John Graham-Brown,<sup>3</sup> Upendra Man Singh,<sup>4</sup> Bhoj Raj Joshi<sup>5</sup>

<sup>1</sup>Department of Research and Innovation, Wern Veterinary Surgeons, Unit 11, Lon Parcwr Industrial Estate, Ruthin, UK

<sup>2</sup>Department of Epidemiology and Population Health, University of Liverpool Institute of Infection and Global Health, Liverpool, UK

<sup>3</sup>Infection Biology, University of Liverpool Institute of Infection and Global Health, Liverpool, UK

<sup>4</sup>Himalayan College of Agricultural Sciences and Technology, Kathmandu, Nepal

<sup>5</sup>Centre for Environmental and Agricultural Policy Research, Extension and Development (CEAPRED), Kathmandu, Nepal

## Correspondence to

Dr Joseph William Angell;  
jwa@liv.ac.uk

Received 22 February 2018

Revised 6 July 2018

Accepted 30 July 2018

## SUMMARY

Current information on the domestic yak (*Poephagus grunniens* or *Bos grunniens*) in the Himalayan agroecological zone in Nepal is limited. Despite their isolation, yak may contact other domestic livestock particularly during the winter when they are at lower altitudes and as such they may be exposed to infectious disease. Faeces from 50 adult yak from a herd of 123 adults and 27 calves in the Kaski region of the Nepali Himalaya were analysed for the presence of gastrointestinal parasites using standard flotation and sedimentation methods. In this herd, 18 per cent (95% CI 9% to 31%) of the samples showed evidence of nematode infection, with trichostrongyle and *Nematodirus/Marshallagia* species eggs being detected. No trematode eggs were detected in any samples, and no *Galba* species or other snails were found in the environment. The herd appeared healthy with low intestinal parasitic burdens. Our findings may indicate *Nematodirus/Marshallagia* species infection to be exclusive to yak in this region.

## BACKGROUND

Current information on the domestic yak (*Poephagus grunniens* or *Bos grunniens*) in the Himalayan agroecological zone in Nepal is limited due to their isolation, inaccessibility and migratory nature, hampering study and connection with livestock services. Indeed, the number of domestic yak, yak hybrids (chauri) and wild yak in Nepal is unknown, with current estimates between 9000 and 95,000.<sup>1-3</sup> Furthermore, information on disease is even less well documented.

Despite their isolation, yak may contact other domestic livestock including cattle, buffalo, goats, and so on, indirectly, particularly during the winter when they are kept at lower altitudes and as such they may be exposed to similar infectious diseases, although current disease information is unavailable.<sup>1</sup> There are a few reports attempting to document the point prevalence of parasitic nematodes and trematodes in yak in different regions of Nepal, although most lack adequate description of the sampling strategies employed.<sup>4,5</sup> Acharya *et al.*<sup>6</sup> report data from 96 yak from six herds in Mustang district, of which gastrointestinal nematodes were detected in 78.13 per cent and trematodes in 35.42 per cent of the animals sampled.

In February 2017, as part of a clinical investigation we carried out a survey to estimate the prevalence of parasitic nematodes and trematodes from a single mixed herd of yak and chauri in the Kaski district.

## CASE PRESENTATION

The herd comprised 123 adult yak/nak (female yak) and 27 calves grazing subalpine pasture at an altitude of between 2800 and 3100 m. The herds were all watered in a single location daily and it was at this site that we carried out faecal sampling. To reduce the likelihood of resampling the same individual twice only fresh faeces were collected in the period immediately after watering. This approach also ensured all animals were present at the time of sampling, meaning it could be reasonably assumed any samples collected would be representative of the adult herd overall. Sample size calculations based on an expected prevalence of 5 per cent<sup>7</sup> suggested that 50 samples should be sufficient to detect this prevalence with a precision of 5 per cent.

## INVESTIGATIONS

Freshly voided faeces from 50 adults were collected and then sealed individually in plastic bags before being transported back to laboratories at the Himalayan College of Agricultural Sciences and Technology in Kathmandu. The samples were analysed individually for the presence of parasites. Salt flotation and enumeration using the McMaster method was carried out for nematodes with a sensitivity of 50 epg<sup>8</sup> and sedimentation for *Fasciola* species eggs was performed using a Flukefinder (Richard Dixon, USA; www.flukefinder.com). Results are displayed in table 1.

In addition to faecal sampling we also interviewed the yak herder and owner about their management, and carried out a survey of the environment in close proximity to the watering area as we considered it potentially suitable for the maintenance of *Galba truncatula*, an intermediate host of *Fasciola hepatica* previously identified in Nepal.<sup>9</sup>

## OUTCOME AND FOLLOW-UP

In this herd, 18 per cent (95% CI 9% to 31%) of the samples showed evidence of nematode infection by faecal egg count, with trichostrongyle (6 per cent of samples (95% CI 1% to 17%)) and *Nematodirus* species or *Marshallagia* species (14 per cent of samples (95% CI 6% to 27%)) eggs being detected. No *Fasciola* species or other trematode eggs were detected in any samples, and following a systematic time limited search no *Galba* species or other snails were found. These results indicate lower levels of infection and fewer helminth species compared with the yak sampled by Acharya *et al.*<sup>6</sup> However,



© British Veterinary Association 2018. Re-use permitted under CC BY. Published by BMJ.

**To cite:** Angell JW, Graham-Brown J, Singh UM, *et al.* *Vet Rec Case Rep* Published Online First: [please include Day Month Year]. doi:10.1136/vetreccr-2018-000618

**TABLE 1** Quantification (epg of faeces) and speciation of nematode eggs as observed using the McMaster salt flotation method; trematode eggs as observed by sedimentation

Sample ID	Trichostrongyle (epg)	<i>Nematodirus/ Marshallagia</i> species (epg)	Trematodes
1	100	50	–
2	–	–	–
3	–	–	–
4	–	–	–
5	–	–	–
6	–	–	–
7	–	50	–
8	–	–	–
9	–	–	–
10	–	–	–
11	–	–	–
12	–	–	–
13	–	–	–
14	–	–	–
15	–	50	–
16	–	–	–
17	–	–	–
18	–	–	–
19	–	–	–
20	–	–	–
21	–	–	–
22	–	–	–
23	–	–	–
24	–	50	–
25	–	–	–
26	50	–	–
27	–	–	–
28	–	50	–
29	–	–	–
30	–	–	–
31	–	–	–
32	–	–	–
33	–	100	–
34	–	–	–
35	–	–	–
36	–	–	–
37	–	–	–
38	–	–	–
39	–	–	–
40	50	–	–
41	–	–	–
42	–	50	–
43	–	–	–
44	–	–	–
45	–	–	–
46	–	–	–
47	–	–	–
48	–	–	–
49	–	–	–
50	–	–	–
Total n (%) samples	3 (6% (95% CI 1% to 17%))	7 (14% (95% CI 6% to 27%))	0
	Any nematode:		0
	9 (18% (95% CI 9% to 31%))		

to our knowledge, herd level prevalence has not been reported previously for any study.

The main outputs from the herd were breeding males, chhurpi (cheese), hair/fibre products and blood used at traditional blood drinking ceremonies. According to the owner and yak herder, they had no interaction with veterinary services and carried out no preventive healthcare measures. They had in the past used a traditional amchi healer when mortality incidence rates were very high (eg, ~50 per cent), although such visits required a journey of two days' walk.

### DISCUSSION

One particular observation we wish to highlight is the detection of *Nematodirus* species and/or *Marshallagia* species eggs. Due to the morphological similarities of their eggs, it was not possible to further distinguish between these two genera on this occasion. To this end, further investigation to determine genus/species level is indicated.

A recent study of the gastrointestinal parasites of yak in the nearby Mustang region reported *Nematodirus* species infection by faecal egg count.<sup>6</sup> Similarly, yak on the Indo-Nepali border have previously been identified with *Nematodirus* species infection, although species level identification was not given,<sup>10</sup> while *N filicollis* infection in yak has been documented previously in Tajikistan.<sup>11 12</sup> *Marshallagia* species infection has also previously been documented in yak in the Qinghai province of China.<sup>13</sup>

Interestingly, studies documenting parasitic species of sheep and goats from the Kaski region did not detect *Nematodirus* species or *Marshallagia* species infection in either sedentary or migratory flocks.<sup>14</sup> Although further investigation is required, our finding may indicate *Nematodirus/Marshallagia* species infection to be exclusive to yak in this region. This may be the result of the increased spatiotemporal isolation of yak from other ruminant species, particularly when grazing higher altitude pasture and/or some degree of host specificity.

Despite the absence of *Fasciola* species or other trematode eggs we cannot rule out infection entirely, since sedimentation methods have a relatively low diagnostic sensitivity.<sup>15</sup> Further sampling and testing using other methodology, for example, postmortem or serology, to further validate this finding would therefore be useful. Furthermore, the failure to identify a viable molluscan intermediate host species may be explained to some extent by the fact that we visited during the dry season. Consequently, presence of such species cannot be ruled out.

This short report highlights the severe lack of public knowledge on the Nepali yak and a lack of communication between yak herders, government officials and the scientific and veterinary communities. The herd appeared healthy at the time of our visit, and had very low intestinal parasitic burdens. Reports of severe mortality rates from unknown causes are alarming. Yak and chauri are considered an essential and integral part of life in the Himalayan agroecological regions, while the lack of interaction with veterinary or extension services hampers the delivery of any meaningful assistance. We would strongly recommend a programme of activity to engage with all animal keepers in order to promote animal welfare and to safeguard the livelihoods of those dependent on their animals. The enormous physical and practical difficulties of working in the Himalaya are not to be underestimated but should not be considered prohibitive.

**Contributors** JWA and JGB conceived the project idea and carried out the fieldwork and laboratory analysis. UMS provided laboratory space and support and

BRJ provided invaluable supervision, liaison, translation and guidance within the country. All authors contributed to the writing of the manuscript.

**Funding** Funding for this project was provided by a grant from the ODA Research Seed Fund from the Higher Education Funding Council for England.

**Competing interests** None declared.

**Provenance and peer review** Not commissioned; externally peer reviewed.

**Data statement** There are no additional data available for this article.

**Open access** This is an open access article distributed in accordance with the Creative Commons Attribution 4.0 Unported (CC BY 4.0) license, which permits others to copy, redistribute, remix, transform and build upon this work for any purpose, provided the original work is properly cited, a link to the licence is given, and indication of whether changes were made. See: <http://creativecommons.org/licenses/by/4.0/>

## REFERENCES

- Joshi DD. Yak in Nepal. *The Yak*. Bangkok, Thailand: FAO regional Office for Asia and the Pacific, 2003:316–22.
- Kharel M, Shrestha BS, Shrestha R. *The Nepali Yak*. Gaththagar, Bhaktapur: Himalayan College of Agricultural Sciences and Technology (HICAST), 2010.
- CBS Nepal, ed. *Agriculture Monograph*. Government of Nepal, 2002. [http://cbs.gov.np/sectoral\\_statistics/agriculture/agriculture\\_monograph\\_preface\\_and\\_contents](http://cbs.gov.np/sectoral_statistics/agriculture/agriculture_monograph_preface_and_contents)
- Byanju R, Shrestha SP, Khanal DR. Prevalence of gastrointestinal parasites in Yaks of Lehe VDC, manaslu conservation area. *Nepal J Sci Tech* 2011;12:366–9.
- Shrestha S, Bindari YR. Prevalence of gastrointestinal parasites of Chauries of Gumdel VDC of Ramechhap District, Nepal. *Net J Agricul Sci* 2013;1:73–4.
- Acharya KP, Nirmal BK, Kaphle K, et al. Prevalence of gastrointestinal and liver parasites in yaks in the cold desert area of lower Mustang, Nepal. *Asian Pac J Trop Dis* 2016;6:147–50.
- Bam J, Deori S, Paul V, et al. Seasonal prevalence of parasitic infection of yaks in Arunachal Pradesh, India. *Asian Pacific J Tropic Dis* 2012;2:264–7.
- Thienpont D, Rochette F, Vanparijs OFJ. *Diagnosing helminthiasis by coprological examination*. 2nd edn. Beerse, Belgium: Janssen Research Foundation, 1986.
- Mahato SN. *Epidemiology and pathogenesis of fasciolosis in Eastern Nepal*. Edinburgh: University of Edinburgh, 1994.
- Ranga Rao GS, Sharma RL, Hemaprasanth. Parasitic infections of Indian yak Bos (poephagus) grunniens--an overview. *Vet Parasitol* 1994;53:75–82.
- Muhhamadve SA. Helminth of cattle and yak in the Tajik SSR. Dushanbe USSR. 1981.
- Aryal GR. *Prevalence of gastrointestinal parasites in chauries of Dolakha District. Himalayan College of Agricultural Sciences and Technology (HICAST)*. Kathmandu, Nepal: Purbanchal University, 2016.
- Dalmasso S, Vesco U. A coprological survey of gastro-intestinal parasitism in the yak (Bos grunniens) from Qinghai Province, People's Republic of China. *Parassitologia* 2008;50:240.
- Joshi BR. *Review ongastrointestinal parasitic diseases of sheep and goats and their possible control strategies in Nepal*. Agricultural Research Station, Lumle, Kaski, Nepal: Lumle Seminar, 2000.
- Duscher R, Duscher G, Hofer J, et al. Fasciola hepatica - monitoring the milky way? The use of tank milk for liver fluke monitoring in dairy herds as base for treatment strategies. *Vet Parasitol* 2011;178:273–8.

Copyright 2018 British Veterinary Association. All rights reserved. For permission to reuse any of this content visit <http://www.bmj.com/company/products-services/rights-and-licensing/permissions/> Veterinary Record Case Reports subscribers may re-use this article for personal use and teaching without any further permission.

Subscribe to Vet Record Case Reports and you can:

- ▶ Submit as many cases as you like
- ▶ Enjoy fast sympathetic peer review and rapid publication of accepted articles
- ▶ Access all the published articles
- ▶ Re-use any of the published material for personal use and teaching without further permission

For information on Institutional Fellowships contact [consortiasales@bmjgroup.com](mailto:consortiasales@bmjgroup.com)

Visit [vetreccasereports.bvapublications.com](http://vetreccasereports.bvapublications.com) for more articles like this and to become a subscriber