EquiSal® Tapeworm detects tapeworm-specific IgG(T) antibodies in horse saliva to provide a tapeworm burden diagnosis of low, borderline or moderate/high. Treatment is recommended for borderline or moderate/high results. The test has the benefit that horse owners themselves can collect the sample to send back to the laboratory for analysis.

- Proven accuracy, equivalent to blood testing
- Salivary IgG(T) antibodies have shorter half life than that reported for IgG(T) antibodies in blood
- Easy sample collection and postage for laboratory testing
- Results reported to horse owners through veterinary surgeons and SQP stockists
- Enables effective targeted worming for tapeworm
- Three quarters of horses tested do not need worming for tapeworm.

**SCIENTIFIC VALIDATION** of EquiSal Tapeworm testing published by Veterinary Clinical Pathology with free access.
Serum and saliva samples were collected from horses at a UK abattoir where tapeworms had been counted. Samples were then analysed in the EquiSal® Tapeworm test or a blood test. EquiSal® saliva scores had strong correlations with both tapeworm numbers and the blood test results. The majority of horses with one or more tapeworms at post-mortem were correctly identified by the test. The remaining few were diagnosed as being low but these horses had burdens considered by experts to be non-pathogenic — less than 20 tapeworms present. Most importantly, no high burden (more than 20 tapeworms) horses were misdiagnosed by the test.

The EquiSal® Tapeworm Test can be relied upon to correctly identify the majority of horses with one or more tapeworms and correctly identify all horses with pathogenic burdens.

The test has both high sensitivity (83%) and specificity (85%).

Post mortem samples
Data from validation experiments demonstrated that EquiSal® Tapeworm saliva scores had strong positive correlation with the blood test serum scores (104 samples), with a Pearson’s correlation of 0.86. The only occasions that the saliva and serum test did not result in the same diagnosis was when there were less than 20 tapeworms present. This number of tapeworms is considered to be non-pathogenic by experts.

Live horse samples
Matched saliva and blood samples, collected from horses within the normal population (133 samples), also demonstrated a strong positive correlation with a Pearson’s correlation of 0.96.

Salivary tapeworm-specific IgG(T) antibody half life
In an ongoing study, EquiSal® Tapeworm testing is carried out every 2 weeks, following tapeworm treatment, on horses diagnosed with tapeworm but with no access to grazing. Data collected so far (19 horses) shows that 50% of horses’ saliva scores had reduced to low within 6 weeks, 90% had reduced within 10 weeks and the remaining 10% of horses taking a further 2 weeks to drop to low. This suggests that antibody responses in saliva have less memory to tapeworm infection than that reported for antibodies in blood.

Mucosal versus humoral antibody responses
Salivary tapeworm-specific IgG(T) antibodies are part of the mucosal immune response to tapeworm infection. A previous study showed tapeworm-specific IgG(T) antibodies being produced at the site of infection and secreted as a local mucosal antibody response1.

In contrast to humoral antibody responses (detected in blood testing), mucosal antibody responses have a much shorter persistence and immunological memory. It can, therefore, be reasonably concluded that the tapeworm-specific antibodies measured in the EquiSal® Tapeworm test are mucosal antibodies produced in the salivary glands by plasma cells that originated as recirculating (via the lymphatic system) B-blasts triggered in the gut submucosa at the site of infection1.

It remains possible that low levels of humoral antibodies could leak into the saliva by transudation or passage through the gingival crevicular space; however, our data suggests that this is not a significant factor.

Salivary tapeworm-specific IgG(T) antibody half life

Mucosal immune response

EFFECTIVE TARGETED WORMING FOR TAPEWORM

Bransby Horses charity undertakes a targeted worming approach for tapeworm control in its herds using EquiSal® Tapeworm for diagnosis. A total of 235 horses and ponies were kept within 28 different fields across 4 main yards between autumn 2015 and spring 2016. The fields are maintained using a variety of different means, including muck collection using mechanical and manual methods, restocking of certain paddocks as well as no muck collection in some fields.

All horses were tested with EquiSal® Tapeworm in autumn 2015 and spring 2016 and only those diagnosed as borderline or moderate/high were treated for tapeworm using praziquantel-based products (dosage determined by weighbridge weight).

The data presented here provides evidence for effective targeting of tapeworm treatment to individual herd members and demonstrates an overall reduction in numbers of horses requiring treatment within the herds.

The following key observations were noted:
- Only 11% of the constant herd members required treatment for tapeworm in Spring 2016 compared with 19% in Autumn 2015. This represents a 41% reduction of horses that required treatment in Spring 2016.
- 92% of horses diagnosed as low in Autumn 2015 remained low in Spring 2016.
- 77% of horses requiring treatment in Autumn 2015 were subsequently low in Spring 2016.
- Only 3 horses diagnosed as moderate/high in Autumn 2015 remained moderate/high in Spring 2016.

**Effective targeted worming: Horses Requiring Treatment in Autumn 2015 and Spring 2016*  

<table>
<thead>
<tr>
<th></th>
<th>Autumn 2015</th>
<th>Spring 2016</th>
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<tbody>
<tr>
<td>Horses not needing treatment</td>
<td>77%</td>
<td></td>
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<tr>
<td>Horses needing treatment</td>
<td></td>
<td>41%</td>
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*using EquiSal Tapeworm diagnosis

HELMINTH RESEARCH PROGRAMME

Our research includes:
- Studies to investigate salivary antibody response to tapeworm infections in relation to management conditions, treatment strategies and reinfection risks.
- Research into tapeworm prevalence using scientific and questionnaire-based data.
- Tapeworm life cycle research including oribatid mite research in conjunction with the Royal Veterinary College and Petplan Charitable Trust.
- Encysted cyathostomin diagnostics in conjunction with the Moredun Institute.
- New saliva-based diagnostic tests within the veterinary sector.

An insight into how tapeworm infections are spread: case study

The case study described here illustrates typical data obtained during studies monitoring tapeworm-specific antibodies in saliva. The figure details EquiSal® saliva scores for Horse A who grazes a well-managed paddock adjacent to Horse C. In February 2015, Horse A was infected by tapeworm, as determined by an increase in saliva score. This finding was unexpected as the horses do not leave the paddock and there are no surrounding paddocks to act as an infection source. However, it was later found that a passing horse had defecated adjacent to the paddock. This is the first anecdotal evidence that intermediate hosts of tapeworm, the oribatid mites, are able to travel. The mites would have ingested tapeworm eggs from the faeces and then moved to a position where Horse A could have ingested them. Horse A’s burden was treated with praziquantel and the saliva score reduced to low burden status and remained low for the duration of the summer.

However, in November 2015 Horse A’s saliva score increased to moderate/high burden status. The hypothesis is that during Horse A’s initial infection, tapeworm eggs released onto the pasture were ingested by resident oribatid mites, where the larvae developed before infecting Horse A. Horse A was treated with praziquantel before again returning to low burden status. During this time, Horse C remained at low burden status until, at the end of January 2016, a moderate/high burden was diagnosed. Horse C was treated with praziquantel and returned to low burden.

There are a number of findings evident from this case study: a) the spread of tapeworm infection between horses, b) the reduction of tapeworm-specific salivary antibodies after treatment and c) the dynamic nature of parasitic infections. Together with numerous other study data we are gathering, this type of case study is expanding our knowledge of tapeworm infections and associated control strategies.

FURTHER DETAIL ON OUR RESEARCH PROGRAMMES CAN BE SEEN ON OUR WEBSITE UNDER NEWS STORIES
The testing process

To provide a reliable diagnosis, the EquiSal® Tapeworm test (patent pending) has to contend with numerous salivary variables such as, saliva flow rate variability, the horse’s recent food intake and presence of particulate matter. To overcome these variables, three ELISAs are conducted on each sample; a Total IgG(T) antibody ELISA, a Non-specific binding ELISA, and a Specific ELISA. An algorithm is then used to generate a saliva score for each sample.

Current tapeworm testing recommendations

The first EquiSal® Tapeworm test should be carried out four months after the last worming treatment for tapeworm. Routine testing should then be carried out every six months. If a horse has a borderline or moderate/high diagnosis, a retest can be carried out two to three months after worming treatment for tapeworm.