Vaccinations of Slaughtered Horses in Finland

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Received May 01, 2013; Revised July 27, 2013; Accepted July 29, 2013

Abstract The purpose of this study was to study the vaccination status of slaughtered horses in Finland. Database of slaughtered horses from Hippos (The Finnish Trotting and Breeding Association) was analyzed and some statistics were calculated. Slaughtered horses (n = 1863) were divided into groups of vaccinated and unvaccinated and, further, into subgroups of regularly and irregularly vaccinated. Age and sex distribution of each group was defined. Differences between these groups defined by vaccination status, age and sex were calculated by χ²-test and t-test. The principal results showed a majority of unvaccinated horses (n = 1030, 55 %), but when vaccinated they were mostly vaccinated according to the recommendations (n = 697, 84 %). Combination of equine influenza and tetanus was mostly favored and all horses were vaccinated against equine influenza. The age of a horse was a critical factor in determining vaccination routines. In conclusion, the nonchalance of some horse owners and the susceptible nature of the horse population in Finland were suspected. A further research project with a vaccination register from competition organizers as well as the disease status among well vaccinated horses was suggested.

Keywords: equine influenza, slaughtered horse, tetanus, vaccination, vaccine

1. Vaccination as a Control of Equine Diseases and Vaccination Program of Horses in Finland

Vaccination constitutes an extremely important part of infectious diseases control programs for horses. The objectives of vaccination are to reduce the likelihood of outbreaks and to reduce the severity of disease in individual horses [1,2]. An old, yet pioneering study in Finland [3] indicates that, for horses vaccinated irregularly or only once before the epidemic, the disease prevalence is about the same as for the unvaccinated animals. In general, it is known that among those with vaccinations some have low levels of immunity [4]. Simultaneously, there are many transfers of horses today, which make strict control of infectious diseases essential [2]. Because equine influenza outbreaks have a severe impact on the horse industry [5], it is important to clarify vaccine status and vaccination routines all over the world.

The animal disease situation in Finland has been good for years. This is continuously monitored by veterinary authorities. The Finnish Food Safety Authority Evira has declared in the publication Animal Diseases in Finland 2011 [6] that no easily spreading and dangerous animal diseases were found in 2011. As regards the horses, blood and swab samples have been collected and post mortem examinations have been carried out. Viruses like herpes and equine arteritis virus and bacteria like streptococcus spp. and Rhodococcus equi have been found, however, in small amounts. Antibodies against herpes and equine arteritis virus have been observed. However, horses do not have serious diseases under a mandatory monitoring program in Finland and the small samples under examination are voluntarily and randomly obtained. This knowledge is insufficient because it does not help to focus vaccinations on areas where they are needed and it does not help to prevent outbreaks, such as the surprising equine herpes virus -1 outbreak that occurred in Finland in spring 2013.

Table 1. Equine vaccinations: vaccination recommendation by the Finnish Food Safety Authority Evira

<table>
<thead>
<tr>
<th>Vaccination</th>
<th>5-6 months</th>
<th>6-7 months</th>
<th>1 year</th>
<th>1.5 year</th>
<th>Booster</th>
</tr>
</thead>
<tbody>
<tr>
<td>influenza + tetanus</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>influenza</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td>intervals from six months to one year</td>
</tr>
<tr>
<td>tetanus</td>
<td></td>
<td>x</td>
<td></td>
<td>every two years or less</td>
<td></td>
</tr>
</tbody>
</table>

Moreover, a vaccination status of horses under Evira’s examination was unknown [6]. The Finnish Food Safety Authority Evira is responsible for the construction of a national vaccination program of horses (Table 1), but there is no knowledge about the number of vaccinations and horse owners’ vaccination routines. It is known that horses in equine sport arenas need to be vaccinated against equine influenza [7,8] and it is registered in the horse passport for checking, but the situation of the population outside sport arenas is still vague. Despite the vaccination checking policy, it is possible to found that horses in national competitions do not have their influenza
vaccinations records in accordance with regulations [9]. This increases the likelihood of spreading of infection during competition. It does not even make sense, since it has been shown that early use of strategic vaccination may significantly reduce the size of outbreak of equine influenza [10,11].

The National vaccination program of the Finnish Food Safety Authority Evira is clear and understandable, but it tells nothing about the type and quality of vaccinations. As early as 2001, an Expert Surveillance Panel including representatives from OIE and WHO made a recommendation on the need to update equine influenza vaccines [12]. Updating should be based on analysis of evidence of disease in well vaccinated horses, antigenic changes, genetic changes and, when possible, experimental data. Respectively, all vaccination procedures should be based on epidemiologically relevant strains [12,13,14].

In the current study the type of vaccinations, vaccination status and vaccination routines in Finland are studied. A hypothesis of a relationship between age and vaccination is established by assuming that older horses are less frequently vaccinated because they no longer take part in the competitions. Old mares are usually in keeping for breeding purposes after their successful career and thus, should be vaccinated at least against abortion caused by herpes virus. A second hypothesis of differences between sexes is set up by assuming that these mares are more often vaccinated.

2. Materials and Methods

In this study vaccination of slaughtered horses was investigated. Data classification based on vaccination type, vaccination status, age and sex of the horse was included in this study design as well as a hypothesis testing procedure. By selecting slaughtered horses it was believed that additional information could be obtained about the vaccinations of horses that are not in active racing.

2.1. Horses

In 2012 the horse population in Finland was 74 100 of which 34 % were warm blood trotters and 26 % Finnhorses. Warm blood horses for riding purposes (half-bred) was the third largest group (25 %) [15]. The number of horses participating in trotting competitions during 2012 was 7500-7600 (10 %) [15]. No statistics on the number of horses in riding competitions was available, but if it is estimated by the number of trotting competitions, only 20 % of the horses were active in sport. However, one horse can appear in these statistics several times, so these figures have only limited value.

It was found in a Hippos (The Finnish Trotting and Breeding Association) database that 1863 horses were slaughtered in 2012. All of these horses slaughtered in 2012 were included in the current investigation because the prevalence of horses with or without vaccination was unknown and thus, the sample size calculation was difficult to implement. Most of the horses (n = 1260, 68 %) were warm blood trotters. Finnhorses were represented at a significantly lower level (n = 439, 24 %). Also half-breed horses (n = 105, 5.6 %), ponies (n = 50, 2.7 %), thoroughbreds (n = 6, 0.3 %) and crossbreds (n = 3, 0.15 %) were slaughtered. Categories such as half-breed and ponies were combinations and in the pony category also the Estonian horse, Iceland, haflinger, Irish cob and Westlands (fjord) were included.

The oldest horse in this database was 35 years old (n = 1). The youngest was four months old (n = 2). The mean age of the horses was 11.3 years. Most of the horses (n = 139, 7.5 %) were five years old (Figure 1). Based on the database, 998 females and 865 males were involved. In these calculations the author did not separate stallions and geldings although in the original database they were separated.

![Figure 1. Age distribution of horses in database (horses less than one year old were excluded)](image)

2.2. Manipulation of Vaccination Data

Horses’ vaccination information was found in a Hippos database based on registration in the horse passport. With the assistance of IT experts from Hippos this data was visualized in a Microsoft Excel Table. This was done by Hippos and none of the processes were visible to the author. Based on this Excel Table more classification was executed. This was under the author’s responsibility. Firstly, horses were divided into two groups; those without vaccines and those with vaccines. Those with vaccines were further divided into two groups; those with one vaccination and those who were vaccinated regularly.

Among the group of vaccinated it was clarified which vaccines have been used. Vaccines, combination vaccines (e.g. Duvaxyn IE-T Plus) and individual combination of these vaccines (e.g. Equilis prequenza + Equip F + Duvaxyn IE Plus + Equip F + Duvaxyn IE Plus) were summarized. Vaccination protocols were defined separately for those vaccinated only once and those vaccinated regularly.

| Table 2. Cross tabulation of the sex of the horses and vaccinations of these horses |
|---------------------------------|-----------------|-----------------|
| female vaccinated n = 335        | female unvaccinated n = 663 |
| male vaccinated n = 498          | male unvaccinated n = 367 |

Secondly, the age distribution of vaccinated was computed because it was hypothesized that vaccination line decreases together with horse ageing and reduced competing. The ages of animals were compared in two groups; all horses in database (from four months to 35-year old) and those vaccinated. Thirdly, the sex of both groups (vaccinated or unvaccinated) was defined and the differences in vaccinations between sexes were calculated (Table 2). This is due to the hypothesis “there is a
difference between males and females” because of old mares usually keeping in breeding purposes after their successful career and thus, should be vaccinated.

2.3. Methodology

The calculations were carried out by SPSS 18.0 statistics program with \(\chi^2\)- test and t-test. Discrete variable, sex, compelled to use \(\chi^2\)- test as an analysis method. Respectively, calculations of differences in ages in both groups were based on comparison of mean values and thus, t-test could be adopted.

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>hevosenkä</td>
<td>1862</td>
<td>11.2626</td>
<td>6.07452</td>
<td>.14077</td>
</tr>
<tr>
<td>hevosenkärokotetut</td>
<td>832</td>
<td>7.6635</td>
<td>3.51544</td>
<td>.12188</td>
</tr>
</tbody>
</table>

### Table 3. Vaccinations and their compositions

<table>
<thead>
<tr>
<th>ProtagFlu with or without tetanus toxoid</th>
<th>Influenza A/equine-2/Ohio/03 (H₃N₈)</th>
<th>Influenza A/equine-2/Newmarket/2/93 (H₃N₈) (and tetanus toxoid)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equilis frequenza with or without tetanus toxoid</td>
<td>A/equine-2/South Africa/4/03</td>
<td>A/equine-2/Newmarket/2/93 (and tetanus toxoid)</td>
</tr>
<tr>
<td>Equip F with or without tetanus toxoid</td>
<td>Influenza A/equi/1 Newmarket 77</td>
<td>Influenza A/equi/2 Kentucky 98 (and tetanus toxoid)</td>
</tr>
<tr>
<td>Duvaxyn IE Plus with or without tetanus toxoid</td>
<td>Influenza A/equi-1/Prague/56 virus (H₃N₈)</td>
<td>Influenza A/equi-2/Newmarket 1/93 –virus (and tetanus toxoid)</td>
</tr>
<tr>
<td>Equilis Resequin</td>
<td>EHV-1, strain RAC-H</td>
<td>EHV-4, strain 2252</td>
</tr>
<tr>
<td></td>
<td>A/equi1/Prague/1/56 (H₃N₈)</td>
<td>A/equi2/Newmarket/1/93</td>
</tr>
<tr>
<td></td>
<td>A/equi2/Newmarket/2/93 (H₃N₈)</td>
<td></td>
</tr>
</tbody>
</table>

### 3. Results

It was indicated that 833 (45 %) horses had been vaccinated. Among these 697 (84 %) were regularly vaccinated. There was no need to calculate the distributions of the vaccines among regularly vaccinated, because they were vaccinated according to the recommendations. Combination of equine influenza and tetanus was the most popular among regularly vaccinated and it was largely used even among those with one vaccination (n = 93/136, 68 %). Other horses with one vaccination were protected against equine influenza (n = 40/136, 30 %) by several vaccines and herpes EHV 1, 4 (n = 3/136, 2 %) by Equilis Resequin with extra virus strains of equine influenza (Table 3). The comprehensive nature of equine influenza vaccine was observed; only five horses in the vaccinated category were left outside this routine equine influenza vaccination procedure. These five horses had vaccine Equilis Resequin with or without a booster. Herpes vaccine Equilis Resequin as extra protection was favored by some owners; 7 % of vaccinated horses (n = 60) were also vaccinated against herpes infection. However, extra protection against strangles and rabies was not found.

The hypothesis of the relationship between age and vaccination was supported (P<0.001). The average age of all horses was 11.3 and for vaccinated horses, respectively, 7.66. Figure 2 illustrates how the vaccination line decreases with age and skews the distribution when all vaccinated horses were included. The average age of vaccinated horses was seven years (mean 7.66, SD 3.5) and horses with age distribution of 5-7 years were mostly vaccinated. But the hypothesis was rejected among those vaccinated only once; the average age was 10 with more variety (mean 9.55, SD 4.6) and one vaccine policy was favored among horses of all ages (from two to 23 years old). Alternative hypothesis of differences between sexes was also endorsed, but contrary to expectation, males were vaccinated more often than females (\(\chi^2 = 159, P < 0.001\)).

### Figure 2. Age of vaccinated horses

4. Discussion

The significance of the results rests on the observation of discontinuous or neglected vaccination protocol.
Perhaps a good animal health situation has prompted the owners to believe that there is no need to worry about the future. As an old study in Finnish conditions has shown [3] these animals vaccinated irregularly or only once, are under a threat of developing a disease. In this way foreign disease outbreaks are closer than before. At the same time, importation of horses from countries with lower-level animal health situation is possible and, under EU regulations, it is easier than before. This is taken seriously in international recommendations [2,5]. In this study, it has not been determined why the owners neglect vaccinations of their horses. Such a questionnaire should be implemented next.

Horses in slaughterhouses are not horses with an active sport status, which might explain the high number of unvaccinated horses. An equine influenza vaccine history of a slaughtered horse could tell a horse’s career in competitions in the past. It could tell that authorized recommendations are implemented. But it is not known when and why the vaccination tradition is lost and boosters are neglected. By combining the register of horses taking part in national competitions and by tracing the path of their life cycle until the end of their life in slaughterhouse, these problems can be better solved. This perspective can be successful when equine influenza vaccines are monitored, but it does not solve the problems with other vaccines. Veterinary authorities have argued that here in Finland there has been no need to impose vaccines as statutory and thus, implementations of vaccinations are difficult to monitor.

The vaccination line of horses decreases with age. Based on the results of this study it would seem that older horses are mostly the ones having only one vaccine in their register. Often, older horses have other diseases with impaired immune status. Owners should be informed to understand the risks that they take in such a situation. It is possible to reduce this risk because it has been evidenced that early use of strategic vaccination may significantly reduce the size of an outbreak [10,11].

In a susceptible population, such as unvaccinated horses in Finland, equine influenza and herpes virus are capable of causing explosive outbreaks. Vaccine provides protection only for a short time and immunological response should be recalled regularly. Investigations show that all vaccines are not equally effective [16,17] and it is globally recognized that there is a need to update equine influenza vaccines [12]. Vaccination procedures in the future should also in Finland be based on epidemiologically relevant strains [12,13,14] and analysis of evidence of disease in well vaccinated horses [12].

5. Conclusions

As a main conclusion, which is drawn from Hippos database, the susceptible nature of the horse population in Finland is recognized. On the other hand, some owners are well informed and they have sought extra protection beyond recommendations by herpes vaccines. During this research project a need for further investigation is observed because the evidence of disease in well vaccinated horses and the vaccination motives of owners are still vague.

Acknowledgement

The author would like to gratefully acknowledge IT help from Suomen Hippos (The Finnish Trotting and Breeding Association).

References