Assessment of prevalence of Fasciola hepatica and associated biochemical alterations in the cattle of Siirt province, Turkey

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ABSTRACT

The aim of this study is to determine the prevalence of Fasciola hepatica in the cattle raised in the Siirt province of Turkey and to obtain epidemiological data about the disease in order to reveal its relationship with certain biochemical parameters. The material of the study consists of a total of 380 cattle. The blood sample was obtained from the jugular vein of the animals. Meanwhile, approximately 50–100 gr of feces were also collected from the animal’s rectum for a fecal examination. The zinc sulfate flotation method was used to inspect the fecal samples. 338 (89%) of samples were found to be seronegative, while the remaining 42 (11%) were seropositive. GGT, ALP, ALT, AST, TP and Albumin parameters analyzed on the serum samples. GGT levels of the seropositive animals were found to be statistically higher compared to the control group. As a result, the ELISA method was confirmed to be more accurate in the diagnosis of fasciolosis, and the increased GGT activity in the serum was determined as a significant indicator of the diagnosis.

Key words: Biochemical parameters, Cattle, Coproscopy, ELISA, Fasciola hepatica.

INTRODUCTION

Fasciolosis is a parasitic disease seen in various animals, particularly in sheep, goats, and cattle. The most commonly encountered species that cause fasciolosis are Fasciola hepatica and F. gigantica (Burgu and Öge, 2003; Tinar, 2003; Kornas et al., 2005).

The most important intermediate host for F. hepatica in Europe is Lymnea truncatula. It is a snail living in still waters and is rarely encountered in collections of water deeper than 50 cm. The snails also have low activity periods in cold periods of winter and hot and arid periods of summer. The optimal temperature for the survival of Lymnea truncatula is 20-22 °C, and it can be encountered in any region that receives an annual precipitation of 250 mm (Güçlü, 2003).

Fasciolosis usually has a chronic course in cattle, and the disease usually originates from infested forages (Holland et al., 2000; Balkaya and Simsek, 2010). The symptoms of the disease include weight loss, anemia, reduced milk yield, submandibular edema, and irregular coat (Kurtınar, 1957; Batmaz, 2010). Post-mortem inspection of sick animals usually reveals that their livers were strongly affected. The infestation may result in partial or complete degradation of the liver and increased economic loss due to this damage (Soundararajan et al., 2000; Kaya et al., 2007; Caya, 2012; Kalu, 2015). The most commonly employed method in the diagnosis of the disease is the fecal inspection.

That being said, the eggs only appear in feces in the mature stage of the parasite and thus diagnosis through fecal inspection only becomes possible at the 13th or 14th week of the disease (Yavuz et al., 2007). Due to this shortcoming, alternative serological methods have been developed to achieve early diagnosis (Öge and Gönenç, 2003; Yavuz et al., 2007).

The aim of this study is to determine the prevalence of F. hepatica in the cattle raised in the Siirt province of Turkey and to obtain epidemiologic data about the disease in order to reveal its relationship with certain biochemical parameters.

MATERIALS AND METHODS

Ethical approval for this study was obtained from the Siirt University Local Ethics Committee for Animal Experiments (DEHAM). (Approval Number: 2017/01/17).

Animal material: The main material of the study consists of a total of 380 cattle of various breed, ages, and sex, raised intensively in different locations of Siirt province. The subjects were chosen randomly.

Fecal examination: Approximately 50 – 100 gr feces were collected from the rectum of each animal for fecal examination. The test samples were then transported to the laboratory and kept at 4 °C till they were examined. The zinc sulfate flotation method was used to inspect the fecal samples.

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ELISA: 5 ml blood samples were collected from the jugular veins of animals into test tubes without anticoagulants. The samples were centrifuged at 3000 rpm for 10 minutes, transported to Eppendorf tubes, and kept at -20ºC till they were analyzed. An ELISA device (Thermo Scientific Multiskan Go) was used with a commercial kit (BIO K 211-Monoscreen Ab ELISA Fasciola hepatica test) to analyze the samples.

Biochemical analyzes: An ADVIA 1800 Chemistry System auto-analyzer was used to conduct γ-glutamyltransferase (GGT), Alkaline phosphatase (ALP), Alanine aminotransferase (ALT), Aspartate aminotransferase (AST), Total protein (TP) and Albumin (Alb) analyzes on the serum samples.

Statistical analyzes: The statistical data obtained from healthy and diseased animals were analyzed with the SPSS v.22 software using a chi-square test. The Student’s test was used to analyze the relationship between biochemical data medians and other available data.

Ethical Approval: Ethical approval for this study was obtained from the Siirt University Local Ethics Committee for Animal Experiments (DEHAM). (Approval Number: 2017/01/17).

RESULTS AND DISCUSSION

The comparison of fecal examination and ELISA findings as diagnostic methods for the disease is presented in Table 1. 338 (89%) of the inspected samples were found to be seronegative, while the remaining 42 (11%) were seropositive. The findings regarding the prevalence of *F. hepatica* in the cattle blood are presented in Table 2. A statistically significant variation was detected between the cattle breeds, where the highest prevalence occurred in native black cattle and the lowest occurred in Eastern Anatolian Red cattle (P<0.01). Table 3 displays the findings regarding the relationship between age and *F. hepatica* prevalence. No statistically significant difference was found between the age groups (p>0.05). Biochemical parameters of healthy and diseased animals are presented in Table 4. Comparison of GGT levels between control and *F. hepatica* group animals reveal a statistically significant increase in the diseased animals (p<0.05). The increases in ALT, AST, and TP levels, and the decrease in ALP and Alb levels were found to be statistically insignificant.

Many studies have been conducted in literature in order to assess the fasciolosis prevalence all over the world (Holland et al., 2000; Shah and Rehman, 2001; Upadhyay and Pachauri, 2001; Cringoli et al., 2002; Magona and Mayende, 2002; Khoramian et al., 2014; Kalu, 2015). While Turkey has climatic and ecological factors that are suitable for the spread of fasciola subspecies, the number of studies conducted on the subject of the prevalence of fasciolosis in cattle is limited (Sen et al., 2011).

Kurtpinar (1957) conducted a study on North East Anatolian Region and reported a prevalence of 40.85% for the disease. Gargili et al. (1999) conducted a post-slaughter study in Thrace and reported the *F. hepatica* prevalence as 0.48%. Simsek et al. (2003) conducted a study using ELISA method and reported a *Fasciola hepatica* seroprevalence as 55%. Sevimli et al. (2005) conducted a post-slaughter study in the province of Afyonkarahisar and reported an *F. hepatica* prevalence of 40.85%.

Table 1: Diagnostic yield of fecal coproscopy and sero-ELISA in detection of fasciolosis in cattle.

<table>
<thead>
<tr>
<th>Examined cattle(n)</th>
<th>ELISA (+)</th>
<th>ELISA (+)</th>
<th>ELISA (-)</th>
<th>Total Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coproscopy (+)</td>
<td>Coproscopy (-)</td>
<td>Coproscopy (+)</td>
<td>Prevalence (%)</td>
</tr>
<tr>
<td>380</td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>27</td>
<td>7</td>
<td>9.52</td>
<td>15</td>
<td>4</td>
</tr>
</tbody>
</table>

Table 2: The prevalence of fasciolosis in relation to cattle breed factor.

<table>
<thead>
<tr>
<th>Age</th>
<th>Examined No.</th>
<th>Positive No.</th>
<th>Prevalence (%)</th>
<th>X²</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>DAK (Eastern Anatolian Red)</td>
<td>16</td>
<td>4</td>
<td>9.52</td>
<td>0.007</td>
<td>P&lt;0.01</td>
</tr>
<tr>
<td>GAK (Southeastern Anatolian Red)</td>
<td>51</td>
<td>7</td>
<td>16.67</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Holstein Friesian</td>
<td>157</td>
<td>6</td>
<td>14.29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Montofon (Brown Swiss)</td>
<td>46</td>
<td>7</td>
<td>16.67</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Simmental</td>
<td>34</td>
<td>5</td>
<td>11.90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yerli Kara (Anatolian Native Black)</td>
<td>76</td>
<td>13</td>
<td>30.95</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall</td>
<td>380</td>
<td>42</td>
<td>100.00</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3: The prevalence of fasciolosis in relation to cattle age factor.

<table>
<thead>
<tr>
<th>Age</th>
<th>Examined No.</th>
<th>Positive No.</th>
<th>Prevalence (%)</th>
<th>X²</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;3</td>
<td>21</td>
<td>4</td>
<td>9.50</td>
<td>0.250</td>
<td>P&gt;0.05</td>
</tr>
<tr>
<td>3-5</td>
<td>174</td>
<td>15</td>
<td>35.70</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;5</td>
<td>185</td>
<td>23</td>
<td>54.80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall</td>
<td>380</td>
<td>42</td>
<td>100.00</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
prevalence of 4.6%. Simsek et al. (2007) conducted a study in the province Elazığ where they utilized indirect-ELISA method and reported an F. hepatica prevalence of 60.5%.

Yildirim et al. (2007) conducted a study in the province of Kayseri and reported a seroprevalence of 65.2% for the disease. Balkaya and Simsek (2010) conducted a post-slaughter study and reported an F. hepatica prevalence of 21%. Sen et al. (2011) conducted a study in the Derinkuyu district of Nevşehir province utilizing both the fecal inspection and copro-ELISA methods and reported 2.02% and 3.03% prevalence for the methods respectively. Akca et al. (2014) conducted a study in the Kars region and reported an F. hepatica seroprevalence of 66.6%. Bostancı and Oğuz (2017) conducted a study in the Van region where they utilized both fecal inspection and copro-ELISA methods and reported 5.07% and 30.7% prevalence for respective methods. Yavuz et al. (2007) conducted a study in the province of Kayseri and reported an F. hepatica prevalence of 15.8% for fecal inspection method and 69.2% for the ELISA method.

According to the Thornwaite climatic classification system, the province of Siirt is located in a humid climatic strip. Lack of water is quite effective in the summer months (Meteoroloji, 2018). The arid conditions of the region are extensive), and time they spend in the forage. The difference (variation) in parameters related to the liver (Shaik et al., 2005). In this study, the GGT levels of the animals infected with F. hepatica were found to be statistically higher compared to the control group (p<0.05). The increases in ALT, AST, and TP levels, and the decrease in ALP and Alb levels were found to be statistically insignificant.

Gundlach and Sadzikowski (1992) conducted a study where they artificially introduced F.hepatica infestation to the calves and reported a similar increase in serum GGT and AST activities in the diseased animals. Bradley (1985) conducted an experimental study on calves for the early diagnosis of F.hepatica and detected that the increase GGT activity was significant. Mert et al. (2003), reported that the changes on the serum AST, GGT, GLDH, total bile acids, sialic acid and lipid-associated sialic acid levels of sheep play a significant role in the diagnosis of the disease. The low amount of increase in AST activity detected in the study of Yasuda et al. (1988) similar are the findings of our study.

In a study which investigated the biochemical parameters of cattle infected with F. gigantica, the GGT, AST, and ALT activities of infected animals were found to have increased statistically compared to the healthy ones, while the increase in TP levels was found to be statistically insignificant (Rajamanickam et al., 1987). The ALP level of the control group in that study was found to be higher compared to the infected animals, which also parallels the findings of the present study.

Various studies (Bulum and Mengi, 2000; Kitila and Megerssa, 2015) have found that the ALP activities of infected animals to be higher compared to the healthy ones. Serum alkaline phosphatase activity seems to result in an inconsistent and wide range of enzymatic activity in F.hepatica infestation, making the enzyme a poor indicator for the liver functions during the disease.

CONCLUSION

As a result, the findings of the present study revealed that ELISA method was more precise in the diagnosis of fasciolosis as compared to fecal inspection, and the increase in serum GGT of the infected animals is an important indicator for the diagnosis.

Conflicts of interest

There are no conflicts of interest.

ACKNOWLEDGMENT

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REFERENCES


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