Occurrence of Caecal Coccidiosis Among Broilers in Gaza strip

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Abstract

Background: Coccidiosis is a health problem resulting in significant economic losses worldwide. The impacts of disease on animal production include, for example, lost revenues, costs of vaccination, prevention, eradication, decontamination and restocking.

Objective: This study aimed to determine the occurrence of caecal coccidiosis among broiler chicken in Gaza strip.

Subjects and methods: The study was conducted during September (which has recorded the highest prevalence), October and November, 2009 in the Gaza strip governorates, Palestine. Randomly 390 broilers caeca were collected from poultry shops, 10 caeca from every poultry shop were sampled. Test tube flotation for caecal content and direct smear scraping of the caeca lining was done to detect *Eimeria tenella* based on the dimensions of oocysts and schizonts respectively. In addition, postmortem was done to detect clinical coccidiosis.

Results: The present study came up with the following findings: The prevalence of sub-clinical caecal coccidiosis was 54.4 %. Multi-variable associations were tested between each variable. Middle governorate represented the highest prevalence (80%). Clinical coccidiosis was only found in groups 1.3 to 1.5 and 1.6 to 1.9 kg with prevalence (9.3%) and (6%), respectively.

Conclusions: The prevalence of the infection increased among the older broiler chicken. Absence of clinical signs of disease does not mean the farm is not infected; diagnosis is based on the presence of lesions at postmortem and the identification. With the aid of a microscope, using direct smear scraping is more sensitive and low cost and time. *E. tenella* in the present study was found to cause clinical signs in broilers.

Keywords: Prevalence, Caecal Coccidiosis, *Eimeria tenella*, Broilers, Gaza strip
ظهر الكوكسيديا الاعورية في الدجاج اللحم في قطاع غزة

ملخص

المقدمة: يعتبر مرض الكوكسيديا أحد المشاكل الصحية في قطاع الدواغين، التي تؤدي لخسارة اقتصادية على مستوى العالم، وتتمثل هذه الخسارة في ضياع الدخل، وتكلفة العلاج، والتحسين، والوقاية، ومكافحة النقص، وعمل على ترطيب قطعان حيوانات من المرض.

الهدف: تهدف هذه الدراسة إلى تحديد ظهور مرض الكوكسيديا الأعورية في الدجاج اللحم في قطاع غزة.

الطريقة والأدوات: أجريت هذه الدراسة خلال 3 أشهر من عام 2009، وهي سبتمبر وأكتوبر وتشمل في محايئات قطاع غزة - فلسطين - حيث تم اختيار 390 عينة عشوائية من أعماء الأعور (الدجاج، اللحم، وأخذت العينات من مناطق متعددة في أماكن مختلفة، وهي عبارة عن 10 عينات من كل محل بيع للدواجن، حيث اعتبار العينات ممثلة عن الطيور، لتكون العينات ممثلة عن قطاعاً، وبعد إجراء التشريح على أعور الدواجن، تم أخذ محتوياته، وفحصه باختبار الطفر الأحادي؛ للكشف عن بيرلس طفيل الإمبريلا تبلا، بسبب لمبرض الكوكسيديا الأعورية، كما تم عمل س/rec من عينة معينة من جدار الأعور باستخدام اختبار المقاومة العبية المباشرة، للكشف عن طيور الشروط لهذا الطيف، كما تم -كذا - عمل الصرف التشريحي للعينة، للكشف عن الأعراض المرضية للمرض التي سبب الأعراض السريرية.

النتائج: أظهرت هذه الدراسة وجود مرض الكوكسيديا الأعورية تحت السريري في الدجاج اللحم في قطاع غزة - فلسطين بنسبة 54.4% بناءً على العديد من المراقبات التي تم استخدامها خلال هذه الدراسة، وقد تم تقييم كل متغير على حدة، ووصلت الدراسة إلى الإمبريلا تبلاPEARLS كأكبر مسببات أولية يمكن مشاهدتها من خلال الفحص التشريحي.

الاستنتاجات:

الكلمات المفتاحية: نسبة الشيوخ، الكوكسيديا الأعورية، الإمبريلا تبلا، الفراري، قطاع غزة.

Introduction

Coccidiosis remains one of the major disease problems of poultry in spite of advances made in prevention and control through chemotherapy, management and nutrition. E. tenella and E. necatrix are the most pathogenic species in addition the disease causes high mortality, morbidity and adverse effects on the growth of infected birds [1-2]. Coccidia of the genus Eimeria are predominately host-specific; each species occurs in a single host species or a group of closely related hosts, infection by coccidia should be in sufficient numbers to produce clinical manifestations of disease that is named coccidiosis. Differential identification of each species is dependent upon the following characteristics; zone of intestine parasitized, gross appearance of the lesion, oocyst morphology, minimum sporulation
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time, minimum prepatent time, schizont size, location of parasite in the host intestinal epithelium and Cross-immunization tests [3]. *E. tenella* infections are found only in the caeca and it is called caecal coccidiosis [4]. In addition it can be recognized by accumulation of blood in the caeca and by bloody droppings. Caecal cores, which are accumulations of clotted blood, tissue debris, and oocysts, may be found in birds surviving the acute stage [5-6]. Caecal coccidiosis causes decreasing of production and economic losses, which can be significant [7].

Animal production sector is one of the most important sectors of Palestinian agriculture. Its importance comes from the increasing investments in the livestock sector. The share of animal production sector of the total agricultural value had increased from 36% to 49% in the West Bank in the seventies and nineties of 20th century respectively. Similar trend occurred in the Gaza strip, as livestock sector share increase from 20% to 30% at the same periods. Now Palestinian farmers in Gaza strip breed more than 15 million broilers per year which hatched locally through importing fertilized eggs from Israel and from abroad. Palestinians consume all that in addition to different types of poultry meat such as turkey, ducks, and imported frozen poultry products [8].

For control of avian coccidiosis, some of the alternatives reviewed include acids, vitamins, probiotics, mushrooms, amino acids, nonsteroidal anti-inflammatory agents, natural feed additives, essential oils and botanicals [9]. Another control approaches have been proposed like; management of poultry house, prophylactic application of anticoccidials, live, attenuated strain based vaccines, immunoprophylaxis [10]. In Gaza strip control strategies are just focused in using anticoccidial drugs in breeding farms. There is no available data on the occurrence of *E. tenella* in Gaza farms, this study will focus on the occurrence and prevalence of *E. tenella* to provide significant information due to its importance from both economic and veterinary health viewpoints.

The aim of the present study was to determine the occurrence of caecal coccidiosis among broilers in Gaza strip.

Subjects and Methods

The study design

The study design was cross sectional which was carried out on live birds in Gaza Strip.

Demography of Gaza strip

The Gaza strip lies on the coast of the Mediterranean. It is bordered by Egypt to the south-west. Climate in Gaza governorates varies from mild
winters, dry and warm to hot summers; It is about 41 kilometers long, and between 6 and 12 kilometers wide, with a total area of 360 square kilometers. The population is estimated to be 1,644,293 inhabitants [11]. High population density, limited land access, and strict internal and external security controls have kept economic conditions in the Gaza strip, the smaller of the two areas under the Palestinian Authority even more degraded than in the West Bank [12].

The study population
The community of the study consisted of all broilers in which were distributed in the five governorates of Gaza strip; Rafah, Khanyonis, Middle, Gaza city and Gaza North. The study period was in the three months of September, October and November in the year 2009. Farmers breed 1.5 million broilers per month that is 4.5 million in 3 months period.

The sampling
The present study was a cross sectional because the prevalence of coccidiosis in chicken farms has not been reported in Gaza strip, the prevalence of infection in each farm was assumed to be 50%. The calculated sample size was 385; using a 95%, level of confidence and 5% desired absolute precision [13]. In the present study, random sampling was used to collect 390 intestinal gut samples (caeca) of broilers from different poultry shops in the markets of Gaza strip. For each shop, 10 birds were collected, which represents a farm. Table1. shows the distribution of the samples among governorates and Table 2. by months.

Table 1. The distribution of the collected samples in Gaza governorates

<table>
<thead>
<tr>
<th>Group</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>North</td>
<td>60</td>
<td>15.38</td>
</tr>
<tr>
<td>Gaza</td>
<td>150</td>
<td>38.46</td>
</tr>
<tr>
<td>Middle</td>
<td>60</td>
<td>15.38</td>
</tr>
<tr>
<td>Khanyounis</td>
<td>60</td>
<td>15.38</td>
</tr>
<tr>
<td>Rafah</td>
<td>60</td>
<td>15.38</td>
</tr>
<tr>
<td>Total</td>
<td>390</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 2. The distribution of collected samples by month

<table>
<thead>
<tr>
<th>Group</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>September</td>
<td>40</td>
<td>10.26</td>
</tr>
<tr>
<td>October</td>
<td>200</td>
<td>51.28</td>
</tr>
<tr>
<td>November</td>
<td>150</td>
<td>38.46</td>
</tr>
<tr>
<td>Total</td>
<td>390</td>
<td>100</td>
</tr>
</tbody>
</table>
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Examination and identification of *E. tenella*
All the collected caecae were kept in an icebox for 8 - 12 hours in the laboratory at 4-8 °C. All samples were examined by qualitative techniques according to recommended standard methods [14].
Clinical disease using postmortem for each bird was recorded. The caeca of gastrointestinal tract was grossly examined carefully.

Qualitative techniques
A large number of different procedures are available for demonstrating coccidia oocysts in poultry faeces. Two methods, which provide qualitative or at the most semi quantitative results will be described below. The most widely used principle for concentration of parasite eggs is flotation [14].

First test: Direct smear scraping
All the caecae were opened, their contents were evacuated, and direct scraping for caecal mucosa was done.
A deep scraping was done of the suspected mucosa with one end of the slide. The material was spread in a very thin layer on a new slide and covered with a cover slip and the thin smear was examined microscopically using 100 x magnification.

Second test: Test tube flotation
All the caecae were opened and their contents (faeces) were collected in a beaker. The faeces were macerated and the suspension was filtered through a muslin cloth and allowed to float. The oocysts in the flotation were separated by flotation method in saturated sodium chloride and sugar solution. They were examined microscopically and the species were identified on the basis of shape and size of oocysts [15].

Clinical coccidiosis
Using postmortem examination, *E. tenella* infections are found only in the caeca and can be recognized by accumulation of blood in the caeca and by bloody droppings. Caecal cores, which are accumulations of clotted blood, tissue debris and oocysts, may be found in birds surviving the acute stage. In this study, chicken that showed caecal core were recorded as clinical cases.

Identification of *E. tenella* using measurement of oocysts
Length and width were measured for 50 oocysts to determine the shape and size of oocyst using Eyepiece graticules, stage micrometers and recording for each positive case.

The statistical analysis
Data were collected and computed by using version 11 Statistical Package for Social Science, (SPSS). Frequencies, mean, standard deviation and chi square were the main statistical treatments made in the present study.
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Results

Parasites detection

Prevalence

Frequency, percent, direct smear scraping to detected *Eimeria tenella* schizont and test tube flotation to detected *E. tenella* oocysts (Figure 1.) were used to determine the prevalence of caecal coccidiosis.

From 390 broilers caecal samples examined, 212 (54.4%) and 129 (33.1) were infected as shown by direct smear scraping and test tube flotation respectively. In addition, clinical coccidiosis was observed in 14 broilers (3.6 %). From 39 stocks, it was found that 22 (56.4%) stocks and 17 (44.7 %) were positive by using direct smear scraping and test tube flotation respectively, while clinical coccidiosis appeared in four stocks only (10.3 %) (Figure 2.).

Figure 1. *E. tenella* oocyst 100 (left) x and shizonts 10 x (right)

From 390 broilers caecal samples examined, 212 (54.4%) and 129 (33.1) were infected as shown by direct smear scraping and test tube flotation respectively. In addition, clinical coccidiosis was observed in 14 broilers (3.6 %). From 39 stocks, it was found that 22 (56.4%) stocks and 17 (44.7 %) were positive by using direct smear scraping and test tube flotation respectively, while clinical coccidiosis appeared in four stocks only (10.3 %) (Figure 2.).
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Figure 2. Prevalence using direct smear scraping, test tube flotation and clinical coccidiosis

Accumulation of blood in caecae was seen in infected birds of clinical coccidiosis (Figure 3.).

Figure 3. Clinical coccidiosis using postmortem

Differences of prevalence among Gaza governorates

Chi-square test was used to determine the differences of prevalence between Gaza governorates. Middle governorate represented the highest prevalence (80%), while in North governorate the prevalence was (66.7%), Khanyounis governorate (50%), Rafah governorate (45%) and Gaza city governorate (44.7%) using direct smear scraping. North showed the highest prevalence (43%), Gaza city (42%), Middle (35%), Khanyounis (20%) and Rafah (11.7%) using test tube flotation. Clinical coccidiosis which was found in 14 birds shows that the North governorate had the highest prevalence 10 (16.7%), Gaza city governorate 3 (2%) and the Middle governorate 1 (1.7%) (Table 3.).

Table 3. Differences of prevalence among Gaza governorates

<table>
<thead>
<tr>
<th>Test Place</th>
<th>Test Count</th>
<th>Infected Count</th>
<th>Not-infected Count</th>
<th>Total</th>
<th>Pearson Chi-Square</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct smear scraping</td>
<td>North</td>
<td>40</td>
<td>20</td>
<td>60</td>
<td>27.821</td>
<td>0.01</td>
</tr>
<tr>
<td></td>
<td>Gaza</td>
<td>67</td>
<td>83</td>
<td>150</td>
<td>25.407</td>
<td>0.01</td>
</tr>
<tr>
<td></td>
<td>Middle</td>
<td>48</td>
<td>12</td>
<td>60</td>
<td>25.407</td>
<td>0.01</td>
</tr>
<tr>
<td></td>
<td>Khan-Younis</td>
<td>30</td>
<td>30</td>
<td>60</td>
<td>25.407</td>
<td>0.01</td>
</tr>
<tr>
<td></td>
<td>Rafah</td>
<td>27</td>
<td>33</td>
<td>60</td>
<td>25.407</td>
<td>0.01</td>
</tr>
<tr>
<td>Test tube flotation</td>
<td>North</td>
<td>26</td>
<td>34</td>
<td>60</td>
<td>25.407</td>
<td>0.01</td>
</tr>
<tr>
<td></td>
<td>Gaza</td>
<td>63</td>
<td>87</td>
<td>150</td>
<td>25.407</td>
<td>0.01</td>
</tr>
<tr>
<td></td>
<td>Middle</td>
<td>21</td>
<td>39</td>
<td>60</td>
<td>25.407</td>
<td>0.01</td>
</tr>
</tbody>
</table>
Differences of prevalence due to weight
Chi-square test was used to determine the differences of prevalence due to weights after dividing the broilers to four groups. It was found that broiler group from 1.6 to 1.9 kg of weight showed the highest prevalence (63.9%) followed by 1.3 to 1.5 kg (62.1%) and the 1 to 1.2 kg (20%) and no prevalence in 2 kg of weight using direct smear scraping. Broiler group from 1.3 to 1.5 kg of weight showed the highest (45%) followed by 1.6 to 1.9 kg (31.1%) and the 1 to 1.2 kg (20%) and no prevalence in 2 kg of weight using test tube flotation. Clinical coccidiosis was only found in groups 1.3 to 1.5 and 1.6 to 1.9 kg with prevalence (9.3%) and (6%) respectively (Figure 4.).

<table>
<thead>
<tr>
<th>Caecal core</th>
<th>Khan-Younis</th>
<th>12</th>
<th>20.0</th>
<th>48</th>
<th>80.0</th>
<th>60</th>
<th>Rafah</th>
<th>7</th>
<th>11.7</th>
<th>53</th>
<th>88.3</th>
<th>60</th>
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</thead>
<tbody>
<tr>
<td>Khan-Younis</td>
<td>12</td>
<td>20.0</td>
<td>48</td>
<td>80.0</td>
<td>60</td>
<td></td>
<td></td>
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<tr>
<td>Rafah</td>
<td>7</td>
<td>11.7</td>
<td>53</td>
<td>88.3</td>
<td>60</td>
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<td></td>
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<td>83.3</td>
<td>60</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gaza</td>
<td>3</td>
<td>2.0</td>
<td>147</td>
<td>98.0</td>
<td>150</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Middle</td>
<td>1</td>
<td>1.7</td>
<td>59</td>
<td>98.3</td>
<td>60</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Khan-Younis</td>
<td>0</td>
<td>0.0</td>
<td>60</td>
<td>100.0</td>
<td>60</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rafah</td>
<td>0</td>
<td>0.0</td>
<td>60</td>
<td>100.0</td>
<td>60</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 4. Differences of prevalence due to weight Differences of prevalence during collection period in Gaza strip

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Chi-square test was used to determine the differences of prevalence during the collection period, where the disease was observed during the entire period of the study in Gaza strip. The prevalence was noted high in September (75 & 72.5%), October (66 & 31.5%) and November (33.3 & 24.7%) using direct smear scraping and test tube flotation respectively. Clinical disease found only in October (14 cases 7%) (Figure 5.).

![Figure 5. Differences of prevalence during collection period in Gaza strip](image)

**E. tenella oocyst size**
Minimum value, maximum value, mean and standard deviation were used in identification of *E. tenella* oocysts using Eyepiece graticules, stage micrometers to determine the size of oocysts; *E. tenella* oocysts size are varied and the mean is 17.8 x 22.2 µm.

**Table 4. Minimum value, maximum value, mean and standard deviation of *E. tenella* oocyst**

<table>
<thead>
<tr>
<th>Measurement/µm</th>
<th>N</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>50</td>
<td>19.50</td>
<td>26.00</td>
<td>22.220</td>
<td>1.648</td>
</tr>
<tr>
<td>Width</td>
<td>50</td>
<td>16.50</td>
<td>21.00</td>
<td>17.830</td>
<td>1.043</td>
</tr>
</tbody>
</table>
Discussion

Parasite detection
Approved technique
Direct smear scraping test, is more sensitive than test tube flotation to detect sub-clinical coccidiosis because the first was used to detect the parasite stage in the caecal mucosa and the second one detects the parasite oocysts in faeces or intestinal contents. Oocyst might be absent during certain periods of the disease, the test tube flotation may give false negative results [16]. In this study, the prevalence using test tube flotation was lower than in direct smear scraping. This may be explained by the fact that the timing of inspection was not appropriate to discover the oocysts.

Prevalence in individual birds and herds
The prevalence in the present study in individual sample and in all herd as one sample was comparable (54.4%) and (56.4%) respectively which give significance of this study to determine the prevalence of the disease using both methods because the birds in same farm are homologous. Clinical disease which was recognized by caecal cores. *E. tenella*, the well-known cause of caecal or bloody coccidiosis invades the two caeca and in severe cases may also parasitize the intestine above and below the caecal junction. Only 14 cases, which were diagnosed, might be due to the marketing before this stage, which appears on the fifth to seventh day of infection.

Differences of prevalence among Gaza governorates
There was a decrease in the prevalence in the samples collected from north to south and which can be referred to early rainfall during the study period and percent of rainfall, which is more in the North which played a role in the high level of moisture which is important for oocyst sporulation [17]. The appearance of highest prevalence of clinical disease in North governorate which were 10 from 14 birds found in the study site support this hypothesis.

Differences of prevalence due to weight
The results of this study showed that the prevalence of the infection increased among the older chicks. Whose weight was 1.7 kg and age from 6–7 weeks. It was found that the prevalence increased with the weight except the weight of 2 kg which might be due to the use of medication [18]. Also, genetically different chicken lines in each study and resistant to infection can’t be neglected. The Excystation of *E. tenella* sporozoites was more rapid in chicks aged 4, 5, and 6 weeks than in those 0, 1, 2, and 3 weeks [19].

This result was in agreement with a study in Northwest of Iran which recorded that the prevalence of infection was increased with the age of the
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chickens, chickens with 5 weeks of age showed the highest prevalence of infection [20]. On the other hand, the result here was contradicted with a study in Saudi Arabia which recorded that the younger chicks were more susceptible to the infection than the older ones [21]. This disagreement may be due to the fact that the older chickens may develop immunity due to their exposure to subclinical infection from the contaminated environment. Or genetic difference birth/weight the chicken lines. Moreover, birds may vary in resistance or susceptibility to infection, phenotypes which are related to immunity and probably genetically determined.

Differences of prevalence during collection period in Gaza strip
The results of this study showed that the disease was observed in all the period of the study in Gaza strip, the prevalence was highest in September because oocyst sporulation may be better in drier, rather than wetter, litter [22]. Moreover, coccidiosis generally occurs more frequently during warmer (May to September) than colder months (October to April) of the year [18].

E. tenella oocyst size
Characteristics of Eimeria spp. were useful in the identification of species and location of parasites in tissues in the intestine, oocyst size, shape, and color. E. tenella is easy to be recognizing because of the characteristics of oocysts, length 19.5 to 26 and width 16.5 to 22.8. The result of this study showed that the mean of E. tenella oocyst size was 17.8 x 22.2 µm, (length 19.5 to 26) and width (16.5 to 21) µm. The findings are more or less similar to others [23].

It is concluded that:
In the present study, the prevalence of sub-clinical caecal coccidiosis among broilers in Gaza strip was 54.4%. There is no commitment to the withdrawal period of anticoccidial drugs among broiler farms. Agriculture, Health, and Economy Ministries, Municipalities, Universities and Veterinarians must cooperate specially in poultry production sector by: Controlling the illegal and misuse of drugs. Proper legislation must be proposed and implemented in Gaza strip. Preventing antibiotics used for human therapy to be used for growth promotion purpose of poultry birds. Coccidiosis vaccine not available in Gaza strip; it is important to be used in both layers and broilers. Changing the strategy of poultry handling in Gaza strip by changing the poultry slaughter shops into stores of poultry meat and all slaughtering must be in central slaughterhouse and distribute the products by cooler vehicles. This step will put all poultry products under
control and inspection and will protect us from the risks of contamination through the distribution the live birds. Conducting research on the economic significance of the poultry diseases and the hazards or drugs residues in the poultry products is in need.

References
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