

# EFFECT OF COCCIDIA (EIMERIA MAXIMA) ON GROWTH PERFORMANCE OF BROILER CHICKEN

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**Abstract:**The present study was carried out for a period of 42 days using 60 one day-old broiler chickens (Hubbard). Half of these were infected with *Eimeria maxima* at 21 days of age by giving 50,000 speculated oocysts to each bird via the mouth to study the effect of coccidia (*Eimeria maxima*) on growth performance parameters such as live body weight, daily weight gain, feed intake, feed conversion ratio and mortality rates of broiler chickens.

After one week of infection (at 28 days of age) it was found that the infected birds showed insignificant decrease of body weight and feed intake compared to non-infected group which were 893.46 gm. vs. 984.67 gm. and 893.88 gm. vs. 934.50gm., respectively. Also, feed conversion ratio (feed/ gain) increased insignificantly in infected birds when compared with non-infected one which was 2.87 vs. 2.36 (the lower value indicates an improved outcome). While, after two weeks of infection (at 35 days of age) the infected birds showed insignificant increase of body weight and feed intake compared to non-infected group which were 1554.43 gm. vs. 1520.34 gm. and 1185.88 gm. vs. 995.00 gm., respectively. Also, it was found non-significant decrease in feed conversion ratio, which was 1.79 (best value) as compared with non-infected chicken (1.87). After three weeks of infection (at 42 days of age) the infected birds showed insignificant increase of body weight and feed intake compared to non-infected group which were 2056.94 gm. vs. 2021.78 gm. and 1158.75 gm. vs. 1147.28 gm., respectively. Also, it was found that feed conversion ratio (feed /gain) increased insignificantly in infected birds when compared with non-infected one which was 2.30 vs. 2.29. During whole period (from 21 days to 42 days of age) it was found that daily weight gain increased insignificantly in infected birds when compared with non-infected one which was 70.27 gm. vs. 68.43 gm. The infected birds showed higher mortality rate at the whole period of experiment which was 13.33% compared to values of the non-infected ones (6.67%).

## INTRODUCTION

Many studies emphasize the negative effect of the infection by the coccidia on the productive performance of the chickens (Waldenstedt *et al.*, 2000a ; Banfield and Forbes 2001 ; Jaipurkar *et al.*, 2002; Mathis *et al.*, 2003;Shojadoost *et al.*,2003; Stanley *et al.*, 2004 ; Mora- Pulido *et al.*, 2005 and Al-baddany,2007). Conway *et al.*, (1993) studied the effect of different levels of oocyst inocula of *Eimeria acervulina*, *E. tenella*, and *E. maxima* in chicken, and they reported that live body weight was significantly depressed by *E.acervulina* beginning at  $10^5$  oocysts per bird, by *E. tenella* at  $10^4$  oocysts per bird, and by *E. maxima* at  $6.7 \times 10^3$  oocyst per bird. However, Banfield and Forbes, (2001) with broiler chicks (Ross) found that live weight on day 35 (after 14 days from infection by *E. acervulina* ) did not differ significantly between treatment groups. Koinarski *et al.*, (2005) with broiler chicken found that, the weight gain in infected chickens with *Eimeria acervulina* was markedly depressed ( $P<0.01$ ) compared with

uninfected chicken. They added that, this decrease was obviously due to the relatively low weight gain (52.2%) in these chickens compared to healthy controls.

Shakshouk, (1984) and (1989); Thyagarajan *et al.*, (1989) ; Adams *et al.*, (1996); Waldenstedt *et al.*, (2000a) ;Waldenstedt *et al.*, (2000b) and Al-baddany, (2007) found significant decrease in the average of feed consumption as a result of infection by coccidia that caused tiredness and inactivity of chicken which led to a decrease in feed consumption.

Kolnarski *et al.*, (2005) with broiler chicken found that feed conversion ratios (FCR) in infected chicken with *Eimeria acervulina* was significantly ( $P < 0.05$ ) higher than in healthy controls (2.33 vs. 1.35). Also, Waldenstedt, (2000a) reached to the point that birds infected by *E. maxima*, *E. praecox* and *E. tenella* showed lower feed conversion by 8%. However, Al-baddany, (2007) found that there is no significant difference between infected chicken by *E. maxima* (1.98) and uninfected ones (1.88) due to the feed conversion.

Scholtyssek, (1963) reported that *E. maxima* seldom caused mortality, but that severe infections in breeder flocks resulted in loss of the usefulness of 25% of the birds. Also, Al-baddany, (2007) found that no significant effect for the infection by coccidia (*E. maxima*) on the mortality rate; and the average of mortality rate for the infected chicken was 2.38% and that was higher than the rate average of mortality for the non-infected chicken by coccidia which was 0.89%.

## MATERIALS AND METHODS

The present study was carried out in the farm of poultry and Laboratories belonging to the department of Animal Production, Faculty of Agriculture and Veterinary Medicine- Ibb University. For a period of 42 days started from 28/3 to 8/5/2008 using 60 one day-old broiler chickens ( Hubbard ) purchased from the company Nakhlan(Sabeha) poultry, for the purpose of studying the effect of coccidia (*Eimeria maxima*) on growth performance.

### Experimental design

On day 21, the sixty birds were divided randomly into two equal groups according to their weights ; group 1 ( control ) and group 2 ( treatment ), with 30 birds each. The chicks in each group were placed on area ( $2 \times 2 \text{ m}^2$ ) at two replicates, with 15 birds in each. At 08.00 a.m on day 21, each bird per the two replicates of group 2 were infected with 50,000 sporulated *Eimeria maxima* oocysts via an oral gavage, directly into the crop (Conway *et al.*, 1993; Allen *et al.*, 1997 and Allen and Fetterer, 2002). While the two replicates of group 1, remained as uninfected group.

### Management of experimental birds

The chicks were kept under similar and standard hygienic and environmental condition. Floor brooder with gas heating were used for brooding chicks up to three weeks of age (incubation period ) , with density of 10 chicks per square meter. Water and diet were offered ad Libitum to the birds; The basal diets used in feeding the chicks were formulated to contain 22% crude protein and 3000 kcal Metabolizing energy and fed in form of dry pellet and free of anticoccidia.

Feed ingredients and proximate analysis of the basal experimental diets are, yellow corn 62.05%, Soya bean meal 27.95% and concentrate mixture 10%.

#### Growth performance parameters

The chicks were weighed to the nearest gram at weekly intervals during the experimental period for the four replicates within the two groups. Daily weight gain was calculated. The average amount of feed consumed per chick in every replicate of the two groups at a certain period was obtained by the difference between the offered amount and the remaining feed to the nearest gram at the same period. Feed conversion ratio was calculated according to the following equation.

The FCR = Feed consumed (g.) in certain period / weight gain (g.) in the same period. At the end of the experiment, the mortality rates were calculated for the four replicates within the two groups.

#### Statistical analysis

Statistical analysis of data obtained was carried out by applying the computer program SAS, (1996). Duncan's test, (1955) was applied between means to test the significance between them. The following model was used:

$$X_{ij} = \mu + \alpha_i + R_j + e_{ij}$$

Where:

$X_{ij}$  = The observation of the  $i^{\text{th}}$  treatment and  $j^{\text{th}}$  replicate;  $\mu$  = The overall mean;  $\alpha_i$  = The effect of  $i^{\text{th}}$  treatment;  $R_j$  = The effect of  $j^{\text{th}}$  replicate;  $e_{ij}$  = Experimental error.

## RESULTS AND DISCUSSION

### Live body weight (LBW)

The infected birds with *Eimeria maxima* showed non-significant decrease in live body weight at 28 days of age (after one week of infection), which was  $893.46 \pm 20.33$  gm. as compared to non infected group ( $984.67 \pm 20.33$  gm.) as presented in Table (1). These results go in agreement with those obtained by Allen and Fetterer, (2002) who showed lower rate of the live body weight of broiler chicken (Ross) between the fourth and seventh days after the infection by *Eimeria maxima* dose of 55000 live mature oocysts at 21 days. Also, Jackson *et al.*, (2003) found that the infected birds with *E.acervulina* and *E.maxima* in the age of 7,11,12 and 13 days were less significantly ( $P < 0.05$ ) in the live body weight compared with those infected and treated birds. Also, our obtained results are in agreement with, Al-baddany, (2007) who found that average live body weight of infected chicken with *E.maxima* decreased significantly ( $p < 0.01$ ) compared with the non-infected ones. We reached to the point that the infection by coccidia lead to a decrease in the live body weight, and the reason for that refers back to the negative effect of coccidia on the digestive system where the parasite of coccidia will reproduce in the alimentary canal, therefore it brings damage for intestinal tissues and the result will be an impediment of nutrition, digestion, absorption and cause dryness and lack of blood, all that together may led to weakness in growth and hence a decrease in the body weight (Saif *et al.*, 2003; Shojadoost *et al.*, 2003; Stanley *et al.*, 2004; Mora-Pulido *et al.*, 2005 and Al-baddany, 2007).

After two and three weeks of infection with *Eimeria maxima* (at 35 and 42 days of age), it was found non-significant increase in the live body weight which was  $1554.43 \pm 19.26$  gm. and  $2056.94 \pm 47$  gm. as compared to value of the non-infected ones  $1520.34 \pm 19.26$  gm. and  $2021.78 \pm 3.47$  gm., respectively. And, this may be returned to the mild pathogenic effect of such type of *Eimeria*. These results disagree somewhat with those obtained by Banfield and Forbes, (2001) with broiler chicks (Ross) who found that live body weight on day 35 (after 14 days from infection by *E.acervulina*) did not differ significantly between treatment groups. In this respect, Turk, (1985) found that live body weight of the infected groups with coccidia (either *Eimeria acervulina*, *E.necatrix*, *E.brunetti* and *E.tenella*) become similar to those of the uninfected controls by the 28<sup>th</sup> day postinoculation.

**Table (1) : Least squares means and standard errors for the effect of**

Classification	No	Initial body weight at 21 days (gm)	SE	body weight at 28 days (gm)	No	body weight at 35 days (gm)	No	body weight at 42 days (gm)	daily weight gain at whole period (gm)
<b>Treatment :</b>									
Non infected birds	30	$584.83 \pm 1.47^*$	30	$904.67 \pm 20.33^*$	30	$1520.34 \pm 19.26^*$	28	$2021.78 \pm 3.47^*$	$68.43 \pm 0.28^*$
Infected birds	30	$581.33 \pm 1.47^*$	29	$891.46 \pm 20.33^*$	27	$1554.43 \pm 19.26^*$	26	$2056.94 \pm 3.47^*$	$70.27 \pm 0.28^*$
		ns				ns		ns	ns
<b>Replicates :</b>									
Rep. 1	30	$582.83 \pm 1.47^*$	30	$927.44 \pm 20.33^*$	29	$1404.34 \pm 19.26^*$	27	$1959.26 \pm 3.47^*$	$67.45 \pm 0.28^*$
Rep. 2	30	$582.33 \pm 1.47^*$	29	$950.69 \pm 20.33^*$	28	$1580.43 \pm 19.26^*$	27	$2079.65 \pm 3.47^*$	$71.24 \pm 0.28^*$

1, 21 days = Initial body weight, 28 days = after one week of infection, 35 days = after two weeks of infection, 42 days = after three weeks of infection, Whole period = from 21 days to 42 days. ns = non significant and \* =  $P < 0.01$ .

#### Daily weight gain (DWG):

The infected birds with *Eimeria maxima* showed slightly increase in daily weight gain at whole period (from 21 days to 42 days of age) which was ( $70.27 \pm 0.28$  gm.) compared with non-infected group ( $68.43 \pm 0.28$  gm.) with nonsignificant differences as presented in Table (1). In this respect, it was found that no significant differences in daily weight gain due to the infection of broiler

chicken by *Eimeria tenella* (Fetterer and Allen, 2001) and by *Eimeria tenella*, *E.acervulina* and *E.maxima* strains (Zulpo *et al.*, 2007). Contrary results has been observed by Allen *et al.*, (1997) who found that, the mean weight gain of broiler chicken that had infected by 50,000 *E.maxima* oocysts was significantly reduced compared to all uninfected chicks. Also, Conway *et al.*, (1993) found that daily weight gain was significantly depressed by *E.acervulina* beginning at  $10^3$  oocysts per bird, by *E.tenella* at  $10^4$  oocysts per bird, and by *E.maxima* at  $(6.7 \times 10^3)$  oocysts per bird. And, Waldenstedt *et al.*, (2000a) reported that the infected broiler chicken (Ross) with coccidia (mixture of fertilized *E.acervulina* and *E.praecox*) led to significant decrease ( $P < 0.001$ ) in the growth rate.

#### Feed intake (FI)

Obtained data in Table (2) show that after one week of infection with *Eimeria maxima* during the acute stage of infection, it was found non significant decrease in feed intake, which was  $893.88 \pm 62.73$  gm. as compared to value of the non-infected ones ( $934.50 \pm 62.73$  gm.). This decrease in the average of feed consumption as a result of *Eimeria maxima* infection that caused tiredness and inactivity of chicken which led to a decrease in feed consumption. As well as may be resulted from desquamation of the epithelial cell lining the intestinal villi and leading to decreasing in absorption of nutrient from intestinal lumen. These results go in agreement with those shown by Welch *et al.*, (1986) and Thyagarajan *et al.*, (1989) who reported that infected birds with different types of coccidia, led to a sharp decline in feed consumption on fourth and fifth day after the infection (during the acute stage of infection). In this respect, it was found that, the infected birds with *Eimeria tenella* (Shakshouk, 1984 and 1989 and Thyagarajan *et al.*, 1989), *Eimeria acervulina* (Adams *et al.*, 1996), with *Eimeria acervulina* and *Eimeria tenella* (Waldenstedt *et al.*, 2000a) and with *Eimeria maxima* and *Eimeria tenella* (Waldenstedt *et al.*, 2000b) decreased significantly in the average of feed consumption during the acute stage of infection. Also, Adams *et al.*, (1996) indicated that the infection with different levels of mature oocysts from *Eimeria acervulina* (600,000-560,000 and 280,000) led to a decline in the consumption of feed and the effective degree were correlated by different doses given to birds.

After two and three weeks of infection with *Eimeria maxima* (during the second and third periods) it was found non-significant increase in feed intake which was  $1185.88 \pm 91.51$  gm. and  $1158.75 \pm 141.92$  gm. as compared to value of the non-infected ones ( $995.00 \pm 91.51$  gm. and  $1147.28 \pm 141.92$  gm., respectively). These results are similar to those of Jaipurkar *et al.*, (2002) who reported that the infection of birds with *Eimeria tenella* showed nonsignificant differences in the feed consumption among all groups in the fourth weeks. They added that in the fifth weeks the infected and untreated birds were recorded higher rate in feed consumption whereas it was less in the intact control and infected birds, and treated with anticoccidia. Also, Lapo *et al.*, (2004) reached to the same conclusion where they found that the group of birds that were given a challenge dose by coccidia was the highest in the consumption of feed, but its productive performance was low comparing with group of control. Contrary results has been observed by Al-baddany, (2007) who reported that infected birds with *Eimeria maxima* showed

highly significant ( $P < 0.01$ ) decreased for feed consumption when compared by uninfected ones.

#### Feed conversion (feed/gain)

The infected birds with *Eimeria maxima* showed non-significant increase in feed conversion at first period (from 21 to 28 days) and third period (from 35 days to 42 days), which was ( $2.87 \pm 0.32$  and  $2.30 \pm 0.21$ ) compared to values of the non-infected ones ( $2.36 \pm 0.32$  and  $2.29 \pm 0.21$ , respectively) as presented in Table (3). These results go in agreement with those obtained by Gonzalez *et al.*, (2001) and Jaipurkar *et al.*, (2002) who noted that birds infected with coccidia led to increase of feed conversion compared with uninfected group. And, with Mathis *et al.*, (2003) who reported that feed conversion in the infected birds by *E.acervulina*, *E.maxima* and *E.tenella* (by dose of 60,000-10,000 and 60,000 oocysts, respectively) increased significantly when compared with untreated and non-infected birds. Also, obtained results agree with those of Al-baddany, (2007) who found that there no significant differences between infected chicken by coccidia (*Eimeria maxima*) and uninfected ones (1.98 vs. 1.88) due to the feed conversion. And, Adams *et al.*, (1996) pointed out that the infection by *Eimeria acervulina* dose (zero-280,000-560,000-600,000) led to increase of feed conversion factor, and the degree of influence was related to the different doses given to birds. However, it was found significant ( $P < 0.05$ ) increase in feed conversion value in the infected broiler chicken with *Eimeria acervulina*, *E.maxima* and *E.tenella* (Conway *et al.*, 1993) and *Eimeria acervulina* and *E.maxima* (Jackson *et al.*, 2003) when compared with

Table (2) : Least squares means and standard errors for the effect of treatment and replicates on feed intake (gm.) of broiler chicken at different periods .

Classification	No	Feed intake at 1 <sup>st</sup> period <sup>1</sup>		Feed intake at 2 <sup>nd</sup> period		Feed intake at 3 <sup>rd</sup> period	
		(gm.)		(gm.)		(gm.)	
Treatment :	30	ns		ns		ns	
	29	$934.50 \pm 62.73^a$		$995.00 \pm 91.51^a$		$1147.28 \pm 141.92^a$	
Infected birds	29	$893.88 \pm 62.73^a$		$1185.88 \pm 91.51^a$		$1158.75 \pm 141.92^a$	
	30	ns		ns		ns	
Replicates :	30	ns		ns		ns	
	29	$916.00 \pm 62.73^a$		$1036.41 \pm 91.51^a$		$1114.62 \pm 141.92^a$	
Rep. 2	29	$912.38 \pm 62.73^a$		$1144.48 \pm 91.51^a$		$1191.42 \pm 141.92^a$	

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### تأثير الكوكسيديا (إيميريا ماكسيما) على النمو في فروج اللحم .

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أجريت هذه الدراسة في مزرعة الدواجن بكلية الزراعة والطب البيطري - جامعة إب لمدة 42 يوم واستخدم فيها 60 كتكوت لحم من نوع هيرد (Hubbard) بمر يوم النصف منها (30 كتكوت) أصيب بالكوكسيديا (إيميريا ماكسيما) عند عمر 21 يوم بواسطة إعطاء 50.000 كيس بيضي ناضج لكل فروج عن طريق الفم وذلك لدراسة تأثير الإصابة بالكوكسيديا (إيميريا ماكسيما) على قياس الأداء الإنتاجي مثل وزن الجسم الحي، الزيادة اليومية لوزن الجسم، استهلاك العلف، معامل التحويل الغذائي ونسبة التفوق.

1- بعد الأسبوع الأول من الإصابة بـ (إيميريا ماكسيما) (عند عمر 28 يوم) أظهرت الطيور المصابة انخفاض غير معنوي في متوسط كل من وزن الجسم الحي ومعامل استهلاك العلف مقارنة بالطيور غير المصابة وقد سجلت 893.46 جرام مقابل 984.67 جرام، 893.88 جرام مقابل 934.50 جرام على الترتيب. أيضا وجد أن معدل التحويل الغذائي (مأكول /زيادة وزنيه) ازداد بشكل غير معنوي في الطيور المصابة مقارنة بالطيور غير المصابة حيث كانت 2.87 مقابل 2.36 (القيمة المنخفضة تدل على عائد أفضل).

2- بعد أسبوعين من الإصابة بـ (إيميريا ماكسيما) (عند عمر 35 يوم) أظهرت الطيور المصابة زيادة غير معنوية في متوسط كل من وزن الجسم الحي واستهلاك العلف مقارنة بالطيور غير المصابة حيث كانت 1554.43 جرام مقابل 1520.34 جرام و 1185.88 جرام مقابل 995.00 جرام على التوالي. وجد أيضا انخفاض غير معنوي في معامل التحويل الغذائي حيث كانت 1.79 (أفضل قيمة) عندما تم مقارنتها بالطيور غير المصابة (1.87).

3- بعد ثلاثة أسابيع من الإصابة بـ (إيميريا ماكسيما) (عند عمر 42 يوم) أظهرت الطيور المصابة زيادة غير معنوية في متوسط كل من وزن الجسم الحي واستهلاك العلف مقارنة بالطيور غير مصابة حيث كانت 2056.94 جرام مقابل 2021.78 جرام و 1158.75 جرام مقابل 1147.28 جرام على الترتيب. أيضا وجد أن معامل التحويل الغذائي (مأكول /زيادة وزنيه) قد ازداد بشكل غير معنوي في الطيور المصابة بـ (إيميريا ماكسيما) (2.30) عندما قورنت مع الطيور غير المصابة (2.29).

4- خلال فترة التجربة (من عمر 21 يوم إلى عمر 42 يوم) أظهرت الطيور المصابة بالكوكسيديا زيادة غير معنوية في الزيادة اليومية لوزن الجسم (70.27 جرام) عندما تم مقارنتها بالطيور غير المصابة والتي سجلت متوسط زيادة يومية قدرها 68.43 جرام. وقد لوحظ زيادة في معدل التفوق للطيور المصابة وقدرت نسبتها بـ 13.33% عند مقارنتها بالطيور غير المصابة والتي سجلت نسبة تفوق 16.67%.