IJABR Vol. 7(2): 185 – 192 (2016)

Original Article

EVALUATION OF THE EFFECTS OF LITTER MATERIALS ON COCCIDIAL OOCYST POPULATION IN DEEP LITTER SYSTEM BROILER CHICKEN

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Submitted: October, 2016; Accepted: November, 2016; Published: December, 2016

ABSTRACT

Coccidiosis is a typical protozoan or parasitic malady in household birds and different fowls, described by enteritis and bloody diarrhoea. A study to evaluate the effects of litter materials on coccidial oocyst population in broiler chickens raised in deep litter system was carried out in dry season (December, 2013 and January, 2014). A total of three hundred and twenty (320) faecal samples were collected from sawdust, maize cob, groundnut husk, and fallen leaves compartments for 8 weeks and analysed for coccidial oocysts. From the 320 faecal samples analysed, 93 (29.06%) were infected with coccidian oocyst, with an overall Geometric Mean Intensity (GMI) of 8.43 (Oocyst per gram of faeces, OPGF). Ground nut husk compartment had the highest mean prevalence of 32.50%, followed by maize cob (31.25 %), and sawdust (30.00 %); fallen leaves had the lowest mean prevalence rate of 22.50 %. Similarly, the intensity of the disease was not the same in the different age category. Coccidiosis in the proportion of 22.50% was recorded in young birds group and was lower than that observed in adult category (35.63%). There was however, significant difference ($P < 0.05$; $\chi 2cal=9.62$; $df=3$) of coccidial infection between these compartments in the age groups. It was concluded that there was no significant difference between oocyst transmission and litters of sawdust, maize cob, Groundnut husk, and fallen leaves ($P > 0.05$; $F_{cal}=0.1136$;d.f=3/28). The current study gave the proof of the endemicity of coccidiosis in deep litter rearing system and the higher rate of the subclinical form of the disease in adult birds.

Key words: *Coccidiosis,* Protozoan*, Eimeria, Apicomplexa,* Deep litter

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INTRODUCTION

Coccidiosis is an infection of fowl brought on by a minute creature or protozoa which causes diarrhoea. This protozoan belongs to the phylum Apicomplexa, and majorly members of the Family Eimeriidae. In poultry, most species have a place with the genus *Eimeria* and taint different destinations in the digestive system. The irresistible procedure is quick (4–7 days) and is depicted by parasite replication in host cells with wide damage to the intestinal mucosa. Poultry coccidia are entirely host-specific, and the various species parasitize specific parts of the stomach related tract (Larry, 2012). Hence, Chickens are easily able to be harmed or influenced by at least 11 species of coccidia in which only seven are substantial types of chicken coccidian: *E. acervulina, E. maxima, E. necatrix, E. mitis, E. praecox, E. brunetti,* and *E. tenella* (Shirley and Harvey, 2000), every species creating in a specific area inside the chick (tube from the mouth to the butt). The most widely recognized species are *Eimeria tenella*, which causes the caecal or grisly sort of coccidiosis, *E. necatrix*, which causes bleeding intestinal coccidiosis, and *E. maxima* and *E. acervulina*, which cause long-lasting intestinal coccidiosis. These seven species are (designed only for/happening only within) chickens and cannot infect other type of birds or birds or (milk-producing animals) (Badran and Lukešová, 2006).

Coccidiosis causes death, malabsorption, inefficient use of feed, damaged/weakened development rate in broilers and decreased egg generation in layers (McDougald, 2003). Bloody (brown, smelly waste from animals), ruffled feathers, blood disorder (that causes weakness), reduced head size and sleepiness are observed. Other signs of infection include bloody diarrhoea due to intestinal (sacs that surround body organs) dying off when countless oocyst and merozoites burst out of the cells. In combination, these health and welfare problems cause huge/extreme money losses to the world (related to chickens, hens, turkeys, etc.) industry more than US$3 billion every year (Dalloul and Lillehoj, 2006). In developing countries of Africa, death as a result of disease are estimated between 20% to 50% however they can ascend as high as 80% amid widespread illnesses (Alamargot, 1987; Alemu, 1995).

For an effective broiler generation, litter assumes a vital part. Litter soak up (like a towel) dampness of droppings, keep floor dry and give protection on the ground and give birds a decent medium on which feeding, watering and other management are performed. The requirements of good litters are accessibility, value, dampness, molecule measure, cleanliness, smoothness and free from molds and comfort ability (Chakma *et al.,* 2012). From literature, normal litter materials utilized worldwide are hacked rice straw, rice husk (RH), sawdust (SD), sugarcane mash, oat bodies, corncobs, pounded corncobs, paper process by items, wood shaving, sand, powder, peat greenery, keshari structures and shelled nut bodies (Ghany *et al*., 1977; Jull, 1979; Ranade and Rajmane, 1990). In a similar study conducted by Chakma *et al.* (2003) on rice husk (RH), sawdust (SD), Wood shavings (WS) and slashed fallen tea leaves (CFTL), Oocyst populace in rice husk was observed to be higher ($p<0.01$) than those on different litters, aside from those raised on wood shaving.

MATERIALS AND METHODS

A total of 80 chickens were reared for a period of 8 weeks in Maize cob, ground nut husk, fallen leaves and sawdust compartment with each compartment housing 20 chickens each. Sample collection was on weekly basis and throughout the period of experiment no anticoccidial was administered. Starting at one week after placement, litters were collected in a specimen bottle weekly from the four compartments. Litter Samples were taken early in the morning between 6:00 am - 8:00 am along a roughly W-formed way beginning and completing toward the sides of one of the long sides of the house. They were quickly taken to the research center within a time of 30 minutes for investigation

Sample Analysis

Direct faecal smear was prepared by making a thin film of fresh faecal material on a slide with room temperature physiological saline. A drop of saline was placed on the slide, and then the faeces was mixed into the drop directly on the slide to emulsify. For faeces already in their liquid state because the animal had diarrhoea, no fluid was needed to spread the faeces over the slide. This was at that point secured with cover slip and viewed under the microscope at 10X and 40X objectives respectively. Samples were then analysed using formol-ether concentration technique in accordance with the method described by Cheesbrough (1999). The oocyst were systematically sought for, counted and recorded on Data sheets.

Data Analysis

The results obtained were analysed statistically for significant difference in disease prevalence and intensity of coccidial infections among chickens raised in different litter/media in deep litter system. Test statistics used includes chi-square (χ^2) to compare prevalent rates, and ANOVA for intensity of infection (GMI) as well as mean weight gain within the 8 weeks of the experiment.

RESULTS

Prevalence and intensity of coccidial oocyst raised in sawdust, maize cob, groundnut husk and fallen leaves compartments, for 8 weeks

Table 1 showed the prevalence and intensity of coccidial oocyst raised in sawdust, maize cob, groundnut husk and fallen leaves compartments, for 8 weeks. In the sawdust compartment, week 5 and 6 had the highest prevalence rate of 50.00%, whereas, week 6 recorded the highest GMI of 19.74 OPGF. No oocyst count was recorded in Week 3 and as such had the lowest prevalence and GMI of 0.00% and 0.00 OPGF respectively. In maize cob compartment, week 6 recorded the highest GMI of 19.94 OPGF with the lowest GMI of 2.78 OPGF appearing in week 4; In ground nut husk compartment however, the highest GMI of 19.42 OPGF was observed in week 8, while the lowest GMI of 2.29 OPGF also appearing in week 4. Likewise lowest prevalence rates of 10% was observed in week 1 and the highest prevalence rates of 40% were observed in multiple weeks for both maize cob and groundnut husk category. Fallen leaves compartment had the highest GMI of 17.32 OPGF in week 6 with the lowest of 0.00 OPGF also appearing in week 4. The lowest and highest prevalence rates of 0% and 40% were observed in weeks 4 and 3 respectively.

Table 1: Weekly prevalence (%) and Intensity (Oocyst per gram of faeces, OPGF) of coccidial oocyst of broilers raised in sawdust, maize cob, groundnut husk and fallen leaves for 8 weeks.

LT		SAWDUST			MAIZE COB			GROUNDNUT HUSK			FALLEN LEAVES		
Wk	No.ex	No.+v	PRV	GMI	No.+v	PRV	GMI	No.+v	PRV	GMI	No.+v	PRV	GMI
1	10	2	0	7.74	1	0	0	1	0	0	2	20.00	8.94
2	10	1	10.00	10.00	3	30.00	10.88	3	10.00	11.00	1	10.00	9.00
3	10	0	0.00	0.00	4	40.00	11.38	4	30.00	11.19	4	40.00	8.89
4	10	3	30.00	3.56	4	40.00	2.78	3	40.00	14.14	0	0.00	0.00
5	10	5	50.00	18.00	3	30.00	7.94	4	30.00	2.29	3	30.00	5.85
6	10	5	50.00	19.74	4	40.00	19.94	4	40.00	9.06	2	30.00	17.32
7	10	4	40.00	3.31	2	20.00	1.00	3	30.00	12.10	3	30.00	12.27
8	10	4	40.00	10.46	4	40.00	6.22	4	40.00	3.53	3	30.00	10.00

KEY
LT- Litter type
PRV- Prevalence
GMI- Geometric Mean Intensity

Prevalence and intensity of coccidial oocyst raised in sawdust, maize cob, ground nut husk and fallen leaves for young (1-4 weeks) and adult (5-8 weeks).
The prevalence and intensity of coccidial infection for young (between 1-4 weeks) and adult (between 5-8 weeks) birds raised in the four compartments were that groundnut husk had the highest mean prevalence of 32.50 %, followed by maize cob (31.25 %), and sawdust (30.00 %); fallen leaves had the lowest mean prevalence rate of 22.50 %. Similarly, from this table, the total prevalence of coccidiosis obtained in sawdust, maize cob, groundnut husk and fallen leaves compartments were 30.00%, 31.25%, 32.5%, and 22.50% respectively.

TABLE 2: Monthly/age group prevalence (%) and intensity (oocyst per gram of faeces, OPGF) of coccidial infection among poultry raised for 8 weeks in sawdust, maize cob, groundnut husk and fallen leaves.

LITTER/MEDIA	AGE OF BROILERS			
		Young	Adult	Total
Saw Dust	No. Exam	40	40	80
	No. Infected (%)	6 (15.00)	18 (45.00)	24 (30.00)
	GMI(OPGF)	5.48	11.24	
Maize Cob	No. Exam	40	40	80
	No. Infected (%)	12(30.00)	13(32.50)	25(31.25)
	GMI(OPGF)	5.82	7.11	
Groundnut	No. Exam	40	40	80
	No. Infected (%)	11(27.50)	15(37.50)	26(32.50)
	GMI(OPGF)	7.89	9.93	
Fallen Leaves	No. Exam	40	40	80
	No. Infected (%)	7(17.50)	11(27.50)	18(22.50)
	GMI(OPGF)	8.92	10.09	

There was significant difference ($P<0.05;\chi^2_{cal}=9.62;df=3$) of coccidial infection between sawdust, maize cob, groundnut husk and fallen leaves compartments between the two age groups

Significant differences observed between weekly intervals

Significant differences were observed in the prevalence level of *Eimeria* infection between week 1 and week 2 ($P<0.05;\chi^2_{cal}=24.24;df=3$); week 2 and week 3 ($P<0.05;\chi^2_{cal}=23.81;df=3$); week 3 and week 4 ($P<0.05;\chi^2_{cal}=70.60;df=3$); week 4 and week 5 ($P<0.05;\chi^2_{cal}=29.02;df=3$); and week 6 and week 7 ($P<0.05;\chi^2_{cal}=7.97;df=3$). However there were no significant difference in prevalence level of *Eimeria* infection between week5 and week 6 ($P>0.05;\chi^2_{cal}=3.42;df=3$); and week 7 and week 8 ($P>0.05\chi^2_{cal};=4.81;df=3$).

DISCUSSION

In this study, It was deduced that the highest GMI for 3 compartments (sawdust-19.74 OPGF; maize cob- 19.95 OPGF; and fallen leaves- 19.42 OPGF) were found in week 6, except that of groundnut husk- 19.42 OPGF which was found in week 8; likewise, the lowest GMI for 3 compartments (maize cob-2.78 OPGF, groundnut husk-2.29 OPGF; and fallen leaves-0.00 OPGF) were found in week 4 except that of sawdust-0.00 OPGF that was found in week 3. There was however, no significant difference in the intensity of coccidial oocyst in the different litter materials in deep litter system ($P>0.05$; $F_{cal}=0.1136;d.f=3/28$). This was in agreement with the work of Demirulus (2006).

Severe coccidiosis in the proportion of 22.50% was recorded in young birds group and was lower than that observed in adult category (35.63%).The result is in agreement with the observation of Etuk *et al*, (2004) who recorded a higher prevalence of coccidiosis in adult layer birds than in other age categories. It was also in agreement with the work of McDougald and Reid (1997), which states that the unapparent form of the infection was observed in adult layer birds in a

proportion of 81.8% of the infected flocks. This is as a result of the visible sign of the subclinical form of coccidiosis. The result obtained, however was not in agreement with the findings of Dakpogan and Salifou, (2013), which states that the intensity of the coccidiosis was severe in young birds with the proportion of 66.6% recorded in group and was significantly ($P < 0.05$) higher than that observed in adult category (9%) which could be as a result of low immunity by young birds. Similarly, from same table, significant difference ($P < 0.05$; $\chi^2_{cal}=9.62$; df=3) of coccidial infection was observed between the two age groups of the four compartments. The prevalence level of *Eimeria* infections in sawdust, maize cob, groundnut husk compartments were in agreement with the work of Dakpogan and Salifou, (2013), whereas, that of fallen leaves is not in agreement with their work, which states that overall coccidiosis prevalence was 36.60%. Similarly, overall coccidiosis prevalence obtained in sawdust, maize cob, groundnut husk and fallen leaves compartments were similar with 27.00% and 31.00% prevalence observed by Yunus *et al*., (2008) and Lunden *et al*., (2010) respectively. These give the proof of the endemicity of coccidiosis in this type of rearing system.

This relatively higher prevalence of coccidiosis could be ascribed to the confinement and deep litter-based rearing system compared to caged birds, according to Lunden *et al*., (2010). The result corroborates past reports, demonstrating that coccidiosis is most normal to poultry under intensive management, particularly those raised on deep litter due to generally higher oocysts collection in the deep litter (Methusela *et al*., 2002; Taylor *et al*., 2007). The fact that the contamination is more common in grown-up layer bird than it is in chick, could be attributed to the way that most coccidian contaminations happen at 3 weeks to 4 weeks old. However, clinical illnesses happen at least one or more weeks later. The infection seem to achieve peak at 5 to 7 weeks of age and as age surpassed 7 weeks, most birds will create insusceptibility and increase resistance to the disease (Taylor et al., 2007; Bowman, 2009). Chicks are not completely immunized and can encounter great mortality in coccidiosis outbreak (Chapman *et al*., 2005). According to McDougald and Reid (1997), Breeder and layer hens are at great risk of coccidiosis outbreak, because they are kept on deep litter for several weeks. The unapparent form of the infection was observed in adult layer birds in a proportion of 81.80% of the infected flocks. This is the visible sign of the subclinical form of coccidiosis with consequently a disastrous economical incidence on the production outcome, especially egg production reduction and the emergence of gastro intestinal poultry diseases involving bacterial opportunistic agents: *Clostridium perfringens, Escherichia coli* and different strains of Salmonella that cause enteritis, wet faecal materials with wet litter and dermatopodosis (Bostvironnois and Zadjian, 2011). According to Sørensen *et al*. (2006), the subclinical coccidiosis considerably depress feed efficiency and egg production and account for 70% of the total coccidiosis disease control cost, since feed cost comprises some 70% of the total production cost in business poultry generation framework (Haug et al., 2008). The current study gave the proof of the endemicity of coccidiosis in this rearing system and the higher rate of

the subclinical form of the disease in adult birds.

Also, Significant differences observed on a weekly basis shows the transmission rate of *Eimeria* infection was relatively low and fairly constant among the young birds at the early weeks of the experiment compared to late weeks when the birds are also advanced in age

CONCLUSION AND RECOMMENDATION

The current study gave the proof of the endemicity of coccidiosis in deep litter rearing system and the higher rate of the subclinical form of the disease in adult birds. It demonstrated that there was no significant contrast between oocyst transmission and litters of sawdust, maize cob, Groundnut husk, and fallen leaves. It can be concluded from the review that the diverse sorts of litter materials (sawdust, maize cob, Groundnut husk, and fallen leaves) had no impact on coccidial oocyst populace on broiler chickens in deep litter system.

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