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E-mail: editorijps@gmail.com

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Association Between Coccidia and Intestinal Helminths in Broiler Chickens

Mauricio E. De Franceschi[1]*, Hebe A. Barrios[2] and Olga S. Filippini[2]
[1]Department of Technology, [2]Department of Basic Sciences,
National University of Luján, Avenida Constitución, 6700, (6700) Luján, Argentina

Abstract: The system of extreme intensivity in which commercial birds are bred favors the simultaneous presentation of many illnesses. Coccidiosis has a big economical importance and it has been studied in combination with a great number of affections like salmonellosis, Marek´s disease clostridiosis, reovirosis, among others. Until now, the relation between the presentation of coccidiosis and other intestinal parasites was not studied. We recollected systematically data on broiler chickens for the period of ten years. The search of coccidios was made by the Serial Scraping Method of the Intestinal Mucosa (SSMIM), while the macroscopical parasites were identified at first. The 80 % of the samples were positive to coccidiosis. From them, the 58.5% were sub-clinical, the 34% clinical degree 1 and the 7.5% clinical degree 2 and 3; these proportions were maintained during the study. In all the analyzed samples the duodenum were affected. The other intestinal sectors were always involved in form combined with this. We found 25 % of farms infected with variable proportions of ascaris, heterakis and tapeworms throughout the 10 years, despite first half of the period showed a greater frequency of findings. The results suggest that throughout the period studied existed a high prevalence of coccidiosis, being the subclinic and clinic presentations slight (degree 1) those of greater frequency. Duodenum was affected in the 100% of the chickens in where we found coccidian indicating the very probable preeminence of *Eimeria acervulina*. It was not detected the relation between the macroscopical presentation of coccidiosis and intestinal parasites.

Key words: Coccidiosis, salmonellosis, Marek´s disease, chickens

Introduction

Extreme intensive conditions whereon commercial broiler chickens are bred, favoured the simultaneous presentation of several affections. Coccidiosis is the disease of greater economic transcendence, not only for the losses that it causes in the animal's productive performance, but also for the enormous investments that its effective control requires. Even though coccidiosis, in broiler chickens, possesses a high degree of prevalence, low clinic and subclinic presentations are the ones that are diagnosed with higher frequency. In this context besides, innumerable affections that can coexist with it should be considered, specially regarding that the methods utilized for its control, exert an action limited by the resistances' development , in the case of anticoccidials, or of vaccine reactions when active immunization is used.

In terms of what's been said issues then the uneasiness to determine the possible interactions that can turn up for the combination of coccidiosis with another etiological factors and the mechanisms that take place in these interactions. Studies realized for several years indicate associations between coccidiosis and Necrotic Enteritis (Al-Sheikhly and Al-Saieg, 1980), Ulcerative Enteritis (Nagi and Marthey, 1972), Marek's disease (Biggs *et al*., 1968), Infection Bursal Diseases (Giambrone *et al*., 1977), Virus of the Reticuloendotheliosis (Motha and Egerton, 1984), Reovirus (Ruff and Rosemberger, 1985), Micotoxins (Huff and Ruff, 1982) and Histomoniasis (McDougald and Hu, 2001). There are several studies likewise, upon the association with diverse species of salmonella (Arakawa *et al*., 1992; Kougt *et al*., 1994; Tellez *et al*., 1994; Qin *et al*., 1995; Pogonka *et al*., 2003).

The works quoted, except exceptions, do not include investigations that indicate the various degrees of epidemiologic association among the different diseases, since they refer rather, to the consequences of the mentioned associations.

Whereas, there is no background in scientific bibliography of extensive works that determine so much the prevalence of intestinal coccidia and helminths in commercial chickens like the possible association between both factors. Some studios published in Japon (Oikawa *et al*., 1977) and in Jordania (Al-Natour *et al*., 2002), deal with the determination of coccidiosis´ prevalence in birds destined for meat. Some further extensive studies were realized in Argentina, which represents partial advances of this present study (Mattiello and De Franceschi, 1994). Regarding intestinal worms, there are several works which determine their prevalence in different production systems, so much extensive like intensive (Wilson *et al*., 1994; Permin *et al*., 1999; Hassouni and Belghyti, 2006) at various countries. Other ones tried to establish the aftereffects of *ascaris*' experimental combination with *eimerias* in turkeys (Norton *et al*., 1992), likewise between *Plasmodium gallinaceum* or *Pasteurerella*

multocida with *Ascaridia galli* in chickens (Juhl and Permin, 2002; Dahl *et al.*, 2002). It was also studied *Ascaridia galli's* possible importance in the salmonellosis' transmission (Chadfield *et al.*, 2001).
Within this referential frame, this work's objective was to determine the association degree between coccidiosis and the various intestinal helminths at broiler chickens farms in Buenos Aires province, as well as the risk factors determined by the presence of both affections. For that reason the prevalence of both etiologies were studied in first place.

Materials and Methods

An epidemiologic study, whereon coccidiosis and helminthiasis were diagnosed in a systematic manner in broiler chickens' farms in Buenos Aires province, was realized during 10 years. 486 farms were analyzed, obtaining a sample from a chicken house – of 10.000 chickens- out of each one. Each sample consisted of 6 birds between 21 and 35 days. This way 97.5% certainty is obtained in the poblacional detection of coccidiosis when its prevalence is about 50% (Mattiello and De Franceschi, 1990).
The studied farms are located at a high poultry concentration zone, corresponding to a belt that includes an area of 200 kilometers to the west, southwest, north and south of Buenos Aires city, which geographically corresponds to the named Pampa Húmeda zone.
Lines Arbor Acres and Cobb's animals represented one of the most important integrations of poultry meat with similar infrastructure characteristics, an average capability of 50.000 chickens, grouped in chicken houses of 10.000, at the ratio of 10 per square metre, with earthen floors, wooden shaving beds and sunflower's nutshell, with an approximate depth of 7 centimetres.
A 10 years period was divided into 10 equal parts. Each one was named "analysis year". As to the poultry barns' infrastructure and their equipment, two stages were considered. In the first stage, half the period considered, linear automatic watering places about 2,5 metres long were utilized, manual gas brooders without thermostat and hopper feeding troughs of 18 kilograms of capability, while in the second half, nipple watering systems of 360 degrees and gas fired brooders with thermostat that offered the animals a further environmental uniform heat, started being used. It was also spread out, at some farms, the use of automatic feeding troughs and, as to the infrastructure, the implementation of evaporative refrigeration systems, ceilings' construction and, more recently, the use of fans.
Sanitary plans were similar at all the farms, with few variants that appeared along the drawn out studied period. Four phases of food were used, the first three with anticoccidials' addition, from which diverse combinations that included practically all of the commercially available products were utilized. No vaccines were used to immunize against coccidiosis.
The coccidiosis' diagnosis was made upon the observation of macroscopic injuries according to Johnson and Reid's intensity scale (Johnson and Reid, 1970) in combination with the Serial Scraping Method of Intestine Mucosa (MRSMI), that ratifies parasite's presence and detects subclinic cases of illness, with 98% of confidence. This method consists in the observation of four duodenal scrapes in the microscope, four of yeyunoileum and two of the caecum upon each of the six birds belonging to the sample (Mattiello and De Franceschi, 1990). On the other hand, intestinal helminths were detected by a simple macroscopic observation in the bird's post-mortem examination.
All observations were transposed to a data base and processed in a statistical form utilizing a statistical analysis software (SPSS). Attaining to investigate hypothesis of association between diagnosis of coccidiosis and intestinal helminths, the Chi-Square of Pearson test was used, in order to study independence or homogeneity among characteristic examined populations, utilizing a statistical significance level of 5% ($p < 0.05$). In some cases whereon estimators' best properties did not verify, the Maximum Likelihood function was applied, in order to obtain consistent and efficient estimators, such as to satisfy marginal restrictions that are not intrinsic of the other calculation method of Multinomials tables (although several observed cells show the zero value) (Bishop *et al.*, 1976).

Table 1: Relation between coccidia and helminthes

Diagnosis of coccidia	Helmints negative %	Helmints positive %
Neg.	77.6	22.4
Subclinic	74.7	25.3
Clinic degree 1	75.2	24.8
Clinic degree 2+3	72.4	27.6

Results and Discussion

All over ten years of analysis, subclinic coccidiosis was diagnosed at 228 farms (46.91%); clinic coccidiosis at 162 (33.33%) and there were 96 negative farms (19.75%). Out of the 162 farms that manifested clinic coccidiosis, 133 were degree 1 of disease, what represents 27.36% of the sampled establishments. There were 27 farms with degree 2 (5.55%) and only 2 with degree 3 (0.41%) (Fig. 1).
The helminths found corresponded to *Ascaridia* genus, and to several undetermined *cestoda's* kinds, in similar proportions. Few parasites of *Heterakis* genus were detected (Calnek, 1997).
Intestinal helminths' diagnoses evolution revealed that, in the first 5 years they presented themselves in a larger quantity regarding the second period, with a sharp decline during the fifth year of analysis. The cause may be due to the changing process in farm's infrastructure and implements, a situation that gave place to better

Table 2: Relation between Coccidiosis' and Helminths' percentages vs Season for 10 years of analysis

Seasons	SCC+H	CC+H	SCC	CC	H	N without parasites	Total
Spring	34.4	22.3	22.8	14.3	0.4	5.8	100
Remaining Seasons	32.1	23.5	18.3	13.7	3.2	9.4	100
Total Percentage upon detected parasites	32.6	23.2	19.4	13.8	2.5	8.4	100

References: SCC: Subclinic Coccidiosis; H: Helminths; CC: Clinic Coccidiosis (degree 1 and 2); N with no parasites: Negative without parasites

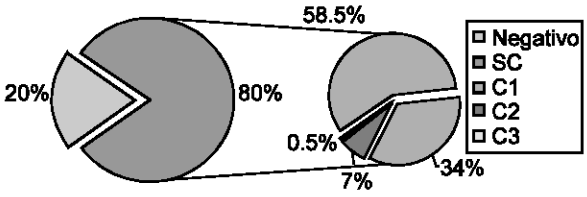

Fig. 1: Percentages of negative and positive cases of coccidiosis' diagnosis and discrimination of percentages of cases corresponding to the various clinical degrees detected; SC: Subclinic coccidiosis; C1: Clinic degree 1; C2: Clinic degree 2 y C3: Clinic degree 3 (J and R scale)

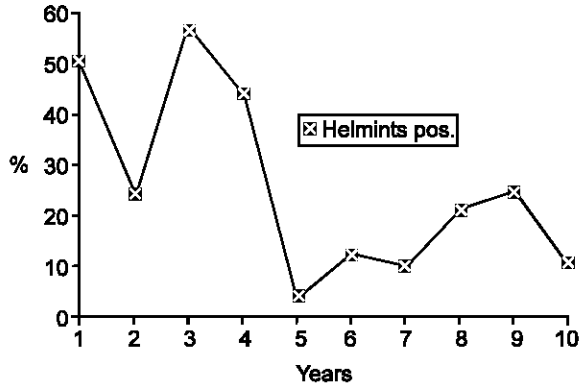

Fig. 2: Evolution of intestinal helminths' presence per year of analysis

environmental conditions determining thus, a minor parasitic defy (De Franceschi and Barrios, 2005) (Fig. 2).

The association among the diverse clinical presentations of coccidiosis relating to the presence or absence of the intestinal helminths found, was set up determining that there was no association between variables (χ^2 = 0.445; p >0.05) (Table 1).

When it was individually compared coccidiosis' presence or absence with intestinal helminths' presence or absence, it was observed a complete independence in the respective percentages, indicating that these diagnoses are not related among themselves (χ^2 = 0.251; p =0.616).

The scarce background that exist regarding these associations were experimental. In turkeys, a decrease in coccidios' quantity was found in the presence of ascaris (Norton *et al.*, 1992). In addition, in chickens, an *Apicomplexa*, the *Plasmodium gallinaceum* alters the course of infection with *Asacaridia galli*. (Juhl and Permin, 2002).

Furthermore, it was studied the relation of each coccidiosis' diagnosis with the presence or absence of intestinal helminths, detecting no significant relation when a Chi^2 test was applied in order to verify any association.

In relation to the seasonal homogeneity of the diverse clinical presentations of coccidiosis and intestinal helminths for the ten years examined, the existence of a significant effect of any of the four seasons was found in each diagnosis' presence (χ^2 = 36.35; p<0.01).

The larger percentages of presence were detected in spring, in subclinic coccidiosis' diagnoses or in diagnoses of coccidiosis together with helminths, and in clinical coccidiosis. (likelihood ratio value 11.82; p<0.05) (Table 2).

The lack of association between coccidiosis and intestinal helminths, revealed that the conditions that made place to coccidia's presence would not be coincident with those that determine another intestinal parasite's existence (De Franceschi, 2004). The improvement in infrastructure and equipment seems to have influenced favourably in the decrease of helminths' prevalence (De Franceschi and Barrios, 2005).

Nevertheless, the frequent reuse of beds and the short resting periods between broods, would be able to revert the situation of no association between coccidiosis and helminthiasis.

On the other hand, the higher frequency of both affections in spring, may be due to a seasonal climatic condition where the increase of the photoperiod, would be able to play some important role, though regarding coccidiosis it would be also possible to suppose a relative decrease in food consumption per thermic increment that would reduce anticoccidial's real dose (De Franceschi, 2004).

Conclusions: The accomplished study allows coming to the following conclusion:

A high prevalence of coccidiosis at farms of the Pampa Húmeda zone is evidenced, which are limited to the low levels (subclinic and clinic degree 1).

1. The improvement in infrastructure's conditions.
2. Intestinal helminths had a moderated prevalence, though it was higher, on the average, in the first half of the period under consideration.
3. Did not exist any epidemiologic association between intestinal helminths' presence and the diverse clinical coccidiosis´ presentations.

4. In spring it was evidenced a larger prevalence of coccidiosis and intestinal helminthiasis.

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