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# Effect of Poultry Viscera Meal Inclusion in Broiler Diets in Different Rearing Periods on Performance, Carcass and Parts Yields

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■ Keywords

Animal byproducts, broiler chickens, carcass yield, performance, poultry viscera meal.

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## ABSTRACT

The objective of the present study was to evaluate the effect of the dietary inclusion of poultry viscera meal (VM) on broiler performance and carcass, parts, and abdominal fat yields in broilers by replacing a diet containing VM with a strictly vegetable diet and vice-versa. A number of 720 one-day-old broiler chicks were randomly distributed in 6 groups: G1- basal diet (BD) - corn and soybean based meal, with no VM from 1 to 42 days of age, G2- 8% VM diet from 1 to 42 days, G3- BD from 1 to 21 and 8% VM diet from 22 to 42 days, G4- BD from 1 to 35 and 8% VM diet from 36 to 42 days, G5- 8% VM diet from 1 to 21 days and BD from 22 to 42 days, G6- 8% VM diet from 1 to 35 and BD from 36 to 42 days. Average body weight, weight gain, feed intake, feed conversion ratio (FCR), production efficiency index, and mortality were determined from 1 to 42 days. There was no effect of treatments on performance or mortality, except for FCR, which was significantly better in the group fed VM from 1 to 35 days and withdrawn at the end of rearing (36-42 days). Also, there were no differences in carcass, parts, and abdominal fat yields, showing that VM in broiler diets does not influence yield parameters.

## INTRODUCTION

Brazil is the largest broiler exporter in the world. The growth of the exported volume is noteworthy, currently reaching 263.2 thousand tonnes. The country is also the third largest chicken meat producer, with an estimated flock of 417.7 million birds (Avisite, 2009). Despite some reduction in production and in global exports, as well as in consumption and imports by some regions due to consumers' fear of possible risks linked to avian flu in the last few years, poultry farming in Brazil continues to be a dynamic and efficient business.

In Brazil, companies that process animal residues for meal and fat production used in animal feeds must comply with a large number of requirements, which are described in Normative Instruction Number 15 of 29 October 2003 of the Brazilian Ministry of Agriculture, Livestock, and Food Supply (MAPA). This regulation sets the standards of hygienic and health conditions and good manufacturing practices (GMP) of these byproducts.

Animal byproducts are used in swine, poultry, and fish feeds. However, the use of fish meal, bovine meat and bones, blood, feathers, viscera, blood plasma, and milk byproducts has been widely discussed, and even banned from animal feeds in some countries, as a result of the consumers' concerns after the bovine spongiform encephalopathy (mad cow disease) outbreak and the contamination of animal food products with *Salmonella* and *Escherichia coli*. When consumers have restrictions to determined food categories, producers have to replace their current production practices by other methods. Today, there is a

clear consumer trend of purchasing healthy foods, which origin, nutritional contents, and quality they know. There clearly is an increasing concern with food safety .

Governmental and non-governmental actions, as well as cultural and religious aspects, have influenced the trend of producing and consuming "healthy foods", e.g., "green" foods, organic food, Halal chicken, etc. Many markets that import chicken meat from Brazil, such as the European Union and the Middle East, require birds not to be fed animal ingredients and chemical growth promoters (Mendes, 2003). According to Regulation (CE) # 1774/2002 of the European Parliament and the European Union Council, Consolidated Text (Consleg, 2004), chapter 1, article 22, the feeding of an animal species with transformed animal proteins derived from bodies, or parts of bodies, of animals of the same species is prohibited.

Due to the consistency of their results, corn and soybean meal (SBM)-based vegetarian diets have been considered reference diets in research evaluating other feedstuffs, including animal meals (Parson & Wang, 1998; Bellaver *et al*., 2001).

Feeding broilers with diets containing animal meals as protein source, partially replacing soybean meal (SBM) is fairly common practice in Brazilian companies. These feeds, if properly processed, are excellent nutrient sources, and have significant low cost. This trend has consequences on production, which motivated us to evaluate the effects of the dietary inclusion of poultry viscera meal (VM) on the performance and carcass, parts, and abdominal fat yields of broilers by replacing a diet containing VM with a strictly vegetable feed and vice-versa.

## MATERIALS AND METHODS

A number of 720 one-day-old male Cobb broilers chicks, derived from 43-week-old breeders, was used. Birds were previously vaccinated against Infectious Bursal Disease (IBD), Marek's disease, and fowlpox, and were reared until 42 days of age. During the experiment, birds were vaccinated against Coccidiosis and IBD via drinking water.

Birds were distributed in a completely randomized block design with 6 treatments (groups) and 4 replicates. Birds were housed in an experimental broiler house measuring 15x4m, with asbestos-tiled roof and open sides with plastic curtains. The house floor was divided in 24 pens (2.5m$^2$). Thirty birds were reared in each pen, at a density of 12 birds/m$^2$.

Water and food were supplied ad libitum. The starter drinkers and feeders were gradually replaced by definitive bell drinkers and tube feeders. A 250-watt infrared light bulb was placed in each pen for brooding, and were removed when chicks were 8 days of age. Temperature and ventilation were manually controlled, as well as the side curtains. Birds received 24 hours of continuous light supplied by incandescent 60W light bulbs.

The following experimental treatments were applied:

G1- corn and soybean meal-based vegetable diet, with no animal byproducts (basal diet) fed from 1 to 42 days of age,
G2- 8% poultry viscera meal (VM) from 1 to 42 days of age,
G3- basal diet (BD) from 1 to 21 days and 8% VM diet from 22 to 42 days of age,
G4- basal diet (BD) from 1 to 35 days and 8% VM diet from 36 to 42 days of age,
G5- 8% VM diet from 1 to 21 days and basal diet (BD) from 22 to 42 days of age,
G6- 8% VM diet from 1 to 35 days and basal diet (BD) from 36 to 42 days of age.

The percentage of VM inclusion in the diet was established as 8% according to the information obtained from broiler companies as to the practical levels they commonly use. Groups G3 and G4 were first fed a strictly-vegetable diet (0% VM), and after a determined age, received the diet containing viscera meal (8% VM). The opposite was done with groups G5 and G6, which were first fed the diet containing VM, and then received the vegetable diet. Birds in group G2 were fed a diet containing VM throughout the entire experimental period (VM up to 42 days). Tissues of broilers from all groups were compared with the respective tissues of the "green chicken" standard (control group - G1), which did not receive any animal ingredient throughout rearing period (vegetable diet up to 42 days).

Diets were formulated to supply the nutritional requirements recommended by Rostagno *et al*. (2000) for a feeding program with two nutritional levels - from 1 to 21 (starter diets) and from 22 to 42 days of age (grower diets). Both diets contained equal energy, protein, calcium, phosphorus, methionine, methionine+ cystine, and lysine levels.

Tables 1 and 2 show the percentage compositions and calculated nutritional contents of the experimental diets.

**Table 1**. Percentage composition of ingredients and calculated nutritional levels of the starter experimental diets (1 to 21 days of age).

| Ingredients (%) | Poultry Viscera Meal, % | |
|---|---|---|
| | 0 | 8 |
| Ground corn | 57.70 | 65.16 |
| Soybean meal | 35.56 | 23.90 |
| Poultry viscera meal | - | 8.00 |
| Soybean oil | 2.64 | 0.10 |
| Calcitic limestone | 0.98 | 0.82 |
| Dicalcium phosphate | 1.83 | 0.80 |
| DL - Methionine | 0.23 | 0.20 |
| L - Lysine | 0.16 | 0.22 |
| Choline chloride (70%) | 0.04 | 0.04 |
| Salt | 0.46 | 0.36 |
| Vitamin-mineral premix[1] | 0.40 | 0.40 |
| Total | 100 | 100 |
| **Calculated Nutritional Levels** | | |
| Metabolizable energy (kcal/kg) | 3000 | 3000 |
| Crude protein (%) | 21.40 | 21.40 |
| Crude fiber (%) | 3.23 | 2.80 |
| Calcium (%) | 0.96 | 0.96 |
| Available phosphorus (%) | 0.45 | 0.45 |
| Methionine (%) | 0.56 | 0.56 |
| Methionine + Cystine (%) | 0.90 | 0.90 |
| Lysine (%) | 1.26 | 1.26 |

1 - Starter vitamin-mineral supplement Vaccinar (levels per kg of diet): vitamin A, 14,000 IU; vitamin D3, 2,500 IU; vitamin E, 25 mg; vitamin K3, 3 mg; thiamine, 2 mg; riboflavin, 5 mg; pyridoxine, 4 mg; vitamin B12, 25 mcg; niacin, 35 mg; pantothenic acid, 12 mg; biotin, 0.10 mg; folic acid, 1 mg; choline, 800 mg; antioxidant (B.H.T.), 2 mg; selenium, 0.18 mg; iron, 50.10 mg; manganese, 78 mg; iodine, 0.70 mg; copper, 10 mg; zinc, 55 mg.

**Table 2** .Percentage composition of ingredients and calculated nutritional levels of the grower experimental diets (22 to 42 days of age).

| Ingredients (%) | Poultry Viscera Meal, % | |
|---|---|---|
| | 0 | 8 |
| Ground corn | 63.25 | 70.66 |
| Soybean meal | 29.82 | 18.18 |
| Poultry viscera meal | - | 8.00 |
| Soybean oil | 3.11 | 0.59 |
| Calcitic limestone | 0.94 | 0.77 |
| Dicalcium phosphate | 1.63 | 0.60 |
| DL - Methionine | 0.22 | 0.18 |
| L - Lysine | 0.22 | 0.28 |
| Choline chloride (70%) | 0.04 | 0.04 |
| Salt | 0.37 | 0.30 |
| Vitamin-mineral premix[1] | 0.40 | 0.40 |
| Total | 100 | 100 |
| **Calculated Nutritional Levels** | | |
| Metabolizable energy (kcal/kg) | 3100 | 3100 |
| Crude protein (%) | 19.30 | 19.30 |
| Crude fiber (%) | 3.00 | 2.57 |
| Calcium (%) | 0.88 | 0.88 |
| Available phosphorus (%) | 0.41 | 0.41 |
| Methionine (%) | 0.51 | 0.51 |
| Methionine + Cystine (%) | 0.83 | 0.83 |
| Lysine (%) | 1.16 | 1.16 |

1Grower vitamin-mineral supplement Vaccinar (levels per kg of diet): vitamin A, 10,000 IU; vitamin D3, 2,000 IU; vitamin K3, 2 mg; thiamine, 2 mg; riboflavin, 4 mg; pyridoxine, 4 mg; vitamin B12, 20 mcg; niacin, 30 mg; pantothenic acid, 10 mg; biotin, 0.06 mg; folic acid, 1 mg; choline, 600 mg; antioxidant (B.H.T.), 2 mg; selenium, 0.18 mg; iron, 50.10 mg; manganese, 78 mg; iodine, 0.70 mg; copper, 10 mg; zinc, 55 mg.

Each ingredient used to manufacture the diets derived from the same batch. The poultry viscera meal (VM) was obtained from a poultry processing plant located in Tietê, State of São Paulo, Brazil. The chemical analysis results of the VM were: 4.81% moisture, 63.48% crude protein, 14.35% ether extract, 12.75% ashes, 3.45% calcium, and 2.57% phosphorus.

All diets and diet residues were weighed to evaluate feed intake (FI). Birds were weighed at hatching and at 42 days of age to determine weight gain (WG). Feed conversion ratio (FCR) was calculated for the period of 1 to 42 days of age. The number of dead birds was recorded daily to calculate livability (L). The production efficiency index (PEI) was also calculated using the following formula: [(DWG x L) / (FCR x 10)], where DWG corresponds to average daily weight gain.

At 42 days of age, 5 birds/pen were randomly selected and slaughtered to evaluate carcass yield parameters. This summed up to 20 birds per treatment, totaling 120 birds. Birds were fasted for six hours, weighed, slaughtered, defeathered, and eviscerated. Carcass (CY), breast (B), drumstick+thigh (DT), wing (W), back (B), head+neck (HN), feet (F), and abdominal fat (AF) yields were evaluated. CY and AF were expressed relative to live body weight after 6-h fasting, whereas the remaining parameters were calculated relative to hot carcass weight with feet and head+neck.

Performance and carcass yield data were submitted to analysis of variance using the procedure GLM of SAS® (SAS Institute, 2000), and means were compared by Tukey' test at 5% probability level.

## RESULTS AND DISCUSSION

There was no effect of treatment on broiler performance parameters or mortality in the period of 1 to 42 days of age, except for feed conversion ratio (Table 3).

At 42 days of age, feed conversion ratio (FCR) was better ($P<0.05$) in treatment G6, in which VM was fed from 1 to 35 days of age and withdrawn at the end of rearing (36-42 days). This treatment was different ($P<0.05$) only from G1, which was fed the strictly vegetable diet, suggesting that diets formulated with animal byproducts improve FCR. Cancherini *et al*. (2005), feeding animal byproducts to 22- to 42-day-old broilers, did not observe any influence of viscera meal inclusion on performance parameters. On the other hand, Cancherini *et al*. (2004), observed better weight gain and FCR when corn and soybean meal-based diets were fed to broilers between 43 and 49

**Table 3**. Mean final weight (FW), daily weight gain (DWG), feed intake (FI), feed conversion ratio (FCR), mortality (MO), and production efficiency index (PEI) of 1- to 42-day old broilers according to the experimental treatments.

| Parameters | Treatments (3) | | | | | | C.V. (%) |
|---|---|---|---|---|---|---|---|
| | G1 | G2 | G3 | G4 | G5 | G6 | |
| FW, g | 2883 | 2864 | 2882 | 2907 | 2854 | 2879 | 2.43 |
| DWG, g | 67.57 | 67.13 | 67.56 | 68.13 | 66.87 | 67.47 | 2.47 |
| FI, g | 4930 | 4795 | 4774 | 4896 | 4798 | 4751 | 1.91 |
| FCR | 1.760a | 1.710ab | 1.696ab | 1.726ab | 1.734ab | 1.690b | 1.83 |
| MO,%[1] | 2.28 | 1.33 | 2.14 | 2.60 | 2.46 | 1.69 | 41.08 |
| PEI[2] | 364 | 386 | 382 | 364 | 363 | 386 | 4.62 |

1 - Percentage data were transformed (x+0,5)1/2 before ANOVA. 2 - Production Efficiency Index = ((DWG x Livability)/FCR) x 10. (3) G1- corn and soybean meal based vegetable diet, with no animal byproducts (basal diet) fed from 1 to 42 days of age, G2- 8% poultry viscera meal (VM) from 1 to 42 days, G3- basal diet (BD) from 1 to 21 days and 8% VM diet from 22 to 42 days, G4- basal diet (BD) from 1 to 35 days and 8% VM diet from 36 to 42 days, G5- 8% VM diet from 1 to 21 days and basal diet (BD) from 22 to 42 days, G6- 8% VM diet from 1 to 35 days and basal diet (BD) from 36 to 42 days. a,b - Means in the same row followed by different letters are significantly different (P<0.05) by Tukey's test.

days of age. Observing the response of broilers fed diets containing meat and bone meal and viscera meal or diets containing corn and soybean meal, Bellaver *et al*. (2005) reported that the performance of birds fed vegetable protein was better than those fed diets containing animal protein.

Animal byproducts should be carefully used, as they are not easily standardized as a result of the differences in production processes and origins of the residues included in animal meals. This may have been one of the reasons of the better performance observed in birds fed the vegetable protein.

There was no difference among treatments as to carcass, parts, and abdominal fat yields (Table 4). Cancherini *et al*. (2004, 2005), using poultry viscera meal, bovine blood meal, and soybean meal as protein sources in broiler chickens diets, also did not observe any statistical differences in carcass, breast, or abdominal fat yields. Similar results were found by Bellaver *et al*. (2005), when replacing vegetable ingredients for animal meals in broiler diets.

Due to the growing feed production, the companies need large volumes of feedstuffs. There are few alternatives to the corn and soybean meal combination. Animal meals are frequently used as alternatives as they ensure nutritional and economic advantages in their formulation, provided their quality is guaranteed. Brazil produces nearly 20 million tonnes of meat. Based cattle, swine, and poultry slaughter figures, the estimated annual production of animal meals from these species is about 2.90 million tonnes, 2.13 million tonnes of fats, and 233,000 tonnes of feather meal. Their economic value is significant, exceeding R$2.5 billion annually. The feed industry profits from a large share of this value, which is equivalent to more than R$20 billion a year (Bellaver, 2005).

Therefore, one must always bear in mind the importance of animal byproducts to the country. Of course, we advocate the improvement of the quality of animal byproducts, so they can be considered as feedstuffs, not as commodities, taking into consideration the nutritional and health quality of feed ingredients (Bellaver *et al*., 2005).

Under the conditions of the present experiment, it

**Table 4**. Carcass, parts, and abdominal fat yields (%) of 42-day-old broilers according to the experimental treatments.

| Parameters | Treatments[3] | | | | | | C.V. (%) |
|---|---|---|---|---|---|---|---|
| | G1 | G2 | G3 | G4 | G5 | G6 | |
| Live weight | 2826.30 | 2801.95 | 2902.25 | 2839.40 | 2787.85 | 2836.85 | 5.70 |
| Carcass (%)[1] | 74.69 | 73.65 | 74.87 | 74.01 | 73.85 | 74.01 | 1.95 |
| Head and neck (%)[1] | 5.57 | 5.53 | 5.26 | 5.27 | 5.45 | 5.36 | 8.16 |
| Feet (%)[1] | 3.78 | 3.81 | 3.76 | 3.83 | 3.81 | 3.81 | 5.88 |
| Abdominal fat (%)[1] | 1.85 | 1.92 | 1.98 | 1.81 | 1.78 | 1.85 | 24.85 |
| Wing (%)[2] | 10.42 | 10.61 | 10.34 | 10.45 | 10.55 | 10.65 | 4.21 |
| Breast (%)[2] | 37.83 | 38.36 | 38.91 | 38.37 | 38.72 | 38.68 | 4.42 |
| Drumstick+thigh(%)[2] | 31.96 | 31.88 | 31.11 | 31.57 | 31.40 | 31.45 | 3.88 |
| Back (%)[2] | 18.88 | 18.88 | 18.67 | 18.91 | 18.81 | 18.66 | 4.67 |

1 - Eviscerated carcass yield, head and neck, feed and abdominal fat (%) = (weight (g) of eviscerated carcass, head and neck, feet, or abdominal fat/live weight (g))x100. 2 - Parts yield (%) = (part weight (g)/ eviscerated carcass weight (g))x100. 3 - G1- corn and soybean meal based vegetable diet, with no animal byproducts (basal diet) fed from 1 to 42 days of age, G2- 8% poultry viscera meal (VM) from 1 to 42 days, G3- basal diet (BD) from 1 to 21 days and 8% VM diet from 22 to 42 days, G4- basal diet (BD) from 1 to 35 days and 8% VM diet from 36 to 42 days, G5- 8% VM diet from 1 to 21 days and basal diet (BD) from 22 to 42 days, G6- 8% VM diet from 1 to 35 days and basal diet (BD) from 36 to 42 days.

is possible to conclude that there is no effect of poultry viscera meal on broiler performance or mortality in the period of 1 to 42 days of age, except for feed conversion ratio (FCR), which was shown to be significantly better in the group in which VM was fed from 1 to 35 days of age and withdrawn at the end of rearing (36-42 days). No difference among treatments was observed in carcass, parts, and abdominal fat yields, showing that VM in broiler diets does not influence carcass yield parameters, either positively or negatively.

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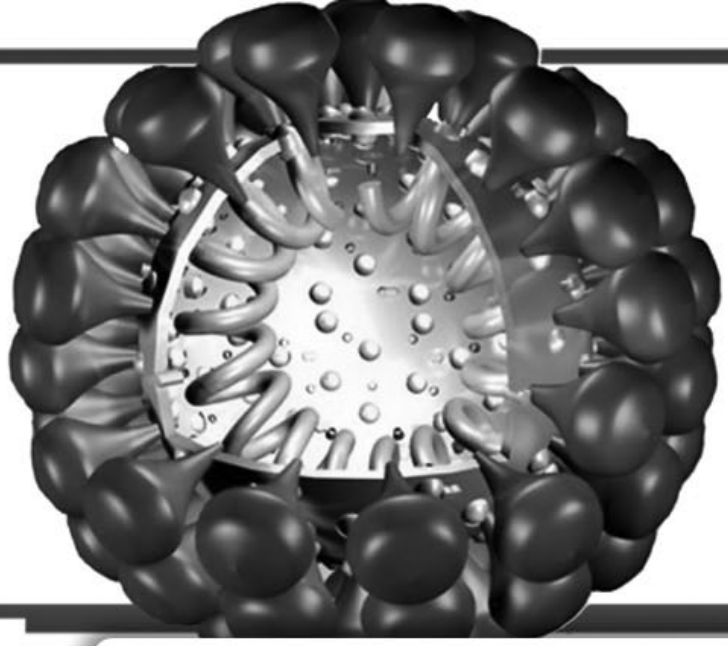

# Workshop sobre Bronquite Infecciosa

## ATUALIDADES E FUTURO DA INCIDÊNCIA E CONTROLE DA BRONQUITE INFECCIOSA (BI) NA INDÚSTRIA AVÍCOLA BRASILEIRA

**Objetivos:**

• Revisar aspectos técnico-científicos da enfermidade viral Bronquite Infecciosa (BI) das Aves;

• Apresentar e discutir a pesquisa científica sobre a BI realizada no Brasil nos últimos anos, visando principalmente as recentes informações sobre a incidência de cepas variantes do vírus da BI nos plantéis brasileiros;

• Revisar a história, situação atual e controle de cepas variantes do vírus da BI ao redor do mundo;

• Discutir a situação brasileira atual e determinar principais caminhos em futuro próximo para um mais efetivo controle desta enfermidade na indústria brasileira.

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