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Biochemical profile of blood of broilers fed oregano, cinnamon and annatto

Perfil bioquímico do sangue de frangos de corte alimentados com orégano, canela e urucum

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Ana Maria Vilas Boas Morais
Undergraduate student of Animal Science at Instituto Federal Goiano - Campus Rio Verde
E-mail: anamariavbm@outlook.com

Alana Maria Barbosa Melo
Undergraduate student of Animal Science at Instituto Federal Goiano - Campus Rio Verde
E-mail: mariaalanab21@gmail.com

Amanda Silva Martins
Undergraduated student at Instituto Federal Goiano- Campus Rio Verde
E-mail: amandasilvamrts@gmail.com

João Guilherme Andrade Camargo
Undergraduated student at Instituto Federal Goiano - Campus Rio Verde
E-mail: joao.camargo@estudante.ifgoiano.edu.br

Lara Vilas Boas Morais
Undergraduate student of Animal Science at Instituto Federal Goiano - Campus Rio Verde
E-mail: laravilas2003@outlook.com

Diego Micheli Sousa Gomes
Undergraduated student at Instituto Federal Goiano -Campus Rio Verde
E-mail: diegomicheli.zoo@gmail.com

Gabriel Carvalho de Andrade

Jordana Martins Costa
Undergraduated student at Instituto Federal Goiano -Campus Rio Verde
E-mail: jordanamartins398@gmail.com

Pablinny Nascimento
Undergraduate student of Animal Science at Instituto Federal Goiano - Campus Rio Verde
pablinnynascimentto@gmail.com

Luana Silva
Undergraduated student at Instituto Federal Goiano-Campus Rio Verde
E-mail: ls44544719@gmail.com

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Cibele Silva Minafra
PhD in Agricultural Biochemistry
E-mail: cibele.minafra@ifgoiano.edu.br

ABSTRACT
The objective was to evaluate the effect of including 2% cinnamon powder, dehydrated oregano and annatto powder in the feed of broilers at 42 days of age, on the biochemical profile of the blood. The experimental design was entirely randomized, with four treatments and seven repetitions of 10 birds. At 42 days of age, blood was collected and serum biochemical evaluation was performed, in which calcium, phosphorus, total protein, cholesterol levels were evaluated with commercial kits and calcium/phosphorus ratio. With this, it is concluded that the inclusion of phytogenic additives present in the feed of broilers at 42 days of age influenced the biochemical profile of the blood and the powdered annatto, a natural pigment, reflected in an improvement of the Ca/P ratio of minerals and plasma protein level. The biochemical profile of cholesterol was not influenced by the 2% cinnamon, oregano and annatto.

Key-words: *Cinnamomum*, *Origanum*, Bixa orellana, poultry, blood serum.

1 INTRODUCTION

Brazil stands out in the scenario of production, export and consumption of chicken meat. The Brazilian production in 2021 of chicken meat was 14.329 million tons, Paraná was the state with the highest percentage of slaughter and then Santa Catarina and Rio Grande do Sul, with 35.54%, 14.89% and 13.65% respectively. The per capita consumption of chicken meat in 2021 was 45.46 kg/inhabitant (ABPA, 2022).

To sustain the development of the entire poultry production chain there are numerous factors that make it possible to obtain high zootechnical rates. Among these factors, the use of feed additives, such as performance-enhancing antibiotics, are used to control pathogens of the gastrointestinal tract, promoting improvement in zootechnical rates and maximizing production (FARAHAT et al., 2016).

Phytogenic additives are compounds derived from plants or herbs and have high levels of bioactive compounds that participate in the secondary metabolism of plants. Phytogens have properties that, when incorporated into animal diets, aim to improve zootechnical indices due to the fact that they improve animal health by enhancing the immune system (DONG et al., 2016)

The biochemical parameters are important indicators of the physiological state of animals, capable of providing information regarding the functioning of organs, adaptation of the animal before nutritional, physiological and environmental challenges, metabolic imbalances and pathologies (FARIA et al., 2021).

The biochemical composition of blood plasma faithfully reflects the metabolic situation

of animal tissues, being possible to evaluate changes in organ function, animal adaptation to nutritional and physiological challenges and specific metabolic imbalances or nutritional origin. However, for a correct interpretation, reference values appropriate for the species to be analyzed are necessary (GONZÁLEZ & SCHEFFER, 2003).

One way to evaluate the metabolism of the bird is to monitor the biochemical constituents of serum and digestive organs such as pancreas and liver. The biochemical constituents reflect the health conditions of the animals and serum analysis is a good signal to evaluate changes in the physiological systems of broilers (MINAFRA et al., 2010).

The objective was to evaluate the biochemical profile of the blood of broilers, fed with oregano, annatto and cinnamon.

2 MATERIAL AND METHODS

The experiment was conducted at the Instituto Federal Goiano Campus Rio Verde. The research project was approved by the IACUCU under protocol 8605090419. The experiment lasted 42 days. The experimental design used was entirely randomized, with four treatments and seven repetitions with 10 birds each, totaling 280 Cobb day-old mixed flock chicks housed in galvanized wire cages with dimensions of 0.90m x 0.60m x 0x45m.

The diet formulation consisted of feed produced according to the recommendations of (ROSTAGNO et al., 2017). Separated into four treatment phases. With feed and water supply, *ad libitium*. According to Table 1.

The control feed was composed of soybean meal and corn. 2% was added to the control rations, cinnamon powder, dehydrated oregano and urucum powder for the other treatments.

On day 42 one bird from each repetition, with the average weight of the experimental plot, was separated for an 8 hour fast. At the end of fasting, the birds were euthanized by cervical dislocation and blood was collected.

For serum biochemical evaluation, the blood of the animals was collected by cardiac puncture and the samples were processed following the methodology described in (MINAFRA et al. (2010). Cholesterol (mg/dl), calcium (mmol/dl), phosphorus (mmol/dl), total protein (g/dl) contents were evaluated, using commercial kits for these analyses and the calcium:phosphorus ratio (mmol/dl).

The data were submitted to analysis of variance using the SISVAR 5.6 program (FERREIRA, 2014) and the means were compared using the F test at 5% probability.

Table 1. Composition of the experimental rations.

Ingredients (Kg)	Pre-initial (1-7 days)	Initial (8-21 days)	Growth (22-35 days)	Final (36-42 days)
Corn	54.30	55.02	60.40	66.00
Soybean meal 45%	38.37	36.93	31.20	25.90
Soybean oil	0.80	1.70	2.90	2.80
Dicalcium Phosphate	0.06	1.25	1.48	1.10
Premix	1.00[1]	1.00[1]	0.80[2]	1.20[2]
Common salt	0.50	0.49	0.48	0.45
DL-Methionine	0.26	0.50	0.29	0.20
L-Lysine	0.30	0.27	0.22	0.40
Limestone	2.2	1.20	0.19	0.20
L-Threonine	0.19	0.07	0.10	0.07
Inert	2.0	2.0	2.0	2.0
Total	100.0	100.0	100.0	100.0
Calculated levels				
Metab. Energy (Kcal/Kg)	3000.00	3100.0	3147.54	3201.18
Raw Protein (%)	25.31	24.50	20.64	18.68
Lysine dig (%)	1.36	1.31	1.12	1.14
Methionine dig (%)	0.55	0.53	0.58	0.46
Phosphorus disp. (%)	0.48	0.43	0.33	0.28
Calcium (%)	1.01	0.84	0.75	0.66
Sodium (%)	0.23	0.21	0.20	0.19

1 Vitamin-mineral Premix (Nutritional Levels per kilo of product): Methionine (Min): 290 g/kg, Iron (Min): 5000 mg/kg, Copper (Min): 1500 mg/kg, Manganese (Min): 14 g/kg, Zinc (Min): 12 g/kg, Iodine (Min): 28 mg/kg, Selenium (Min) 70 mg/kg, Vitamin A (Min): 1500000 IU/kg, Vitamin D3 (Min): 500000 IU/kg, Vitamin E (Min): 3333 IU/kg, Vitamin K3 (Min): 250 mg/kg, Vitamin B1 (Min): 300 mg/kg, Vitamin B2 (Min): 1000 mg/kg, Vitamin B6 (Min): 500 mg/kg, Vitamin B12 (Min) 3333 mcg/kg, Niacin (Min): 6667 mg/kg, Calcium Pantothenate (Min): 2000 mg/kg, Folic Acid (Min): 280 mg/kg Biotin (Min): 8. 3 mg/kg, Choline Chloride (Min): 70 mg/kg. 2 Vitamin Mineral Premix (Nutritional Levels per kilo of product) -Methionine (Min): 300 g/kg, Iron (Min): 6000 mg/kg, Copper (Min): 1850 mg/kg, Manganese (Min): 16.8 g/kg, Zinc (Min): 14. 5 g/kg, Iodine (Min): 330 mg/kg, Selenium (Min) 84 mg/kg, Vitamin A (Min): 1500000 IU/kg, Vitamin D3 (Min): 500000 IU/kg, Vitamin E (Min): 3600 IU/kg, Vitamin K3 (Min): 240 mg/kg, Vitamin B1 (Min): 300 mg/kg, Vitamin B2 (Min): 1100 mg/kg, Vitamin B6 (Min): 500 mg/kg, Vitamin B12 (Min) 3600 mcg/kg, Niacin (Min): 7000 mg/kg, Calcium Pantothenate (Min): 2000 mg/kg, Folic Acid (Min): 320 mg/kg Biotin (Min): 6 mg/kg, Choline Chloride (Min): 65 mg/kg.

3 RESULTS AND DISCUSSIONS

The biochemical constituents of the blood reflect the health conditions of the animals, as well as various factors, such as type of nutrition, climate and management, which may reflect on the results of the serological analyses. For this reason that the determination of blood biochemical parameters in birds should be traced to the conditions under which the animal was subjected. In Brazil, there is scarcity of data on reference levels for biochemical values in broilers, so the importance of tracing this blood profile of birds in the various situations of experimentation (Minafra et al, 2010)

It has stimulated research in animal nutrition focused on finding alternatives to replace synthetic ingredients in animal feed, without loss of productivity or increase in production cost (Garcia et al., 2012).

This research with phytogenic additives, also shows how much a profile of the health of broilers. Table 2 shows the results of the blood serum analysis of broilers fed a corn and soybean meal based diet with the inclusion of 2% oregano, cinnamon and annatto.

Table 2. Blood serum analysis of broilers fed a corn and soybean meal based diet with inclusion of cinnamon, oregano and annatto.

	Phosphorus	**Calcium**	**Ca/P ratio**	**Total Protein**	**Cholesterol**
Control	4,040 c	7,610 b	1,885 a	3,050 ab	221,25
Cinnamon	9,071 a	10,386 a	1,146 b	2,854 ab	198,284
Oregano	5,574 b	7,435 b	1,352 b	2,716 b	211,856
Anatto	4,004 c	7,421 b	1,858 a	3, 211 a	192,393
Probabilities					
CV*	7,19	10,42	13,70	6,76	10,69
P value	0,0000	0,0008	0,0006	0,0212	0,2884
Standard Error	0,2038	0,4279	0,1068	0,1000	11,0041

Coefficient of variation. Equal letters in the same row were not considered different by the tukey test, and different letters in the same row were different by the tukey test.

According to Table 2 we can observe that when cinnamon was included in the broiler feed, the phosphorus and calcium values increased significantly in relation to the control, oregano and annatto treatments.

The Ca/P ratio did not obtain a significant difference between the control and annatto treatments, but differed from the other treatments. Dietary phosphorus and calcium are associated in the metabolism for absorption, and a 2:1 ratio (calcium: phosphorus) is recommended for optimization in the absorption rate. The unbalance in one of these can interfere in the homeostasis process of both components (ANDRIGUETTO et al. 1990).

Observing the parameter of total protein we can observe that including urucum in the feed of broiler chickens obtained a significant increase in relation to the control, oregano and urucum treatments. The values of total protein in poultry species are usually lower when compared to mammals, ranging from 2.5 to 4.5 g/dL (HARR, 2002). In general, the main factors that affect the concentrations of total proteins in birds are: age, seasonality, breeding conditions (management) and diseases (CAPITELLI & CROSTA, 2013).

Cinnamon species (*Cinnamomum verum, C. cassia, C. burmannii e zeylanicum*) possess anti-inflammatory, antifungal, antioxidant and antimicrobial properties in the body of birds. The main bioactive compound of cinnamon is cinnamaldehyde and eugenol, which are present in the bark, leaf and essential oils (ZHANG et al., 2019). Among their actions, the active ingredients of cinnamon have immunomodulatory activity and reduce blood cholesterol levels (KUMAR et al., 2019). In this case, there was no change in the cholesterol profile.

The thermogenic additive increases the availability of minerals and improves the antioxidant status of birds (PIRGOZLIEV et al., 2019), In this case the calcium and phosphorus values were better, however, the Ca/P ratio was unbalanced.

Origanum vulgare Lamiaceae (oregano) presents antimicrobial properties due to the presence of the compounds carvacrol and thymol (NAZER et al., 2005; SILVA et al., 2005). ABUDABOS et al. (2018) found that the addition of oregano in the feed of Ross 308 chickens challenged by *Clostridium perfringens* reduced intestinal lesions with optimization in intestinal morphology, besides decreasing the inflammatory character response and with improvements in the specific immunity of the animals. In this case, there was a decrease in plasma protein that may differ from this study.

Reports by RAMIREZ et al. (2021) demonstrated that the essential oil of oregano in the diet of ISA Brown laying hens at 70 weeks of age had greater thickness of the shell, using the dosage of 150 and 80 ppm of essential oil in the diet. This demonstrates that there was an alteration in the calcium, however, in this study a decrease in this value in the blood was observed, but there was an alteration between the treatments.

The use of annatto (*Bixa orellana L.*), a plant of the Bixaceae family, is gaining prominence for both human and animal food. The main pigment of annatto is the Bixiga, an oily extract that can be obtained from the seed pulp, which has a red-orange color (Braz et al., 2007). In poultry farming, this pigment has been used both for layers and broilers, as a way to make the products more attractive.

Bixiga does not have pro-vitamin A activity, like most carotenoids, and, although smaller than the usual carotenoids, it has antioxidant properties, due to the presence of a chain of alternating conjugated double bonds (Giuliano et al., 2003). Among the natural carotenoids, Bixiga stands out as one of the most effective in protecting cells and tissues against the deleterious effects of free radicals, being also an effective inhibitor of lipid peroxidation (Zhang et al., 1991; Silva et al., 2001). For this fact, the cholesterol concentration was not affected and was associated with an improvement in the protein value.

4 FINAL CONSIDERATIONS

It is concluded that the inclusion of 2% cinnamon powder, dehydrated oregano and urucum powder in the diet of broilers at 42 days of age influenced the biochemical profile of the blood of broilers, but the urucum reflected an improvement in the Ca/P ratio of minerals and plasma protein

level. The biochemical profile of cholesterol was not influenced by the 2% cinnamon, oregano and annatto.

REFERENCES

ABPA. Associação Brasileira De Proteína Animal. **Relatório Anual de 2022.** Brasil, 2022. Disponível em: <https://abpa-br.org/wp-content/uploads/2022/05/Relatorio-Anual-ABPA-2022-1.pdf>. Acesso em: 09 de dez. 2022.

ANDRIGUETTO J. M. **Nutrição Animal**. 4.ed. São Paulo: Nobel, 1990. p.396.

Abudabos, A. M.; Alyemni, A. H.; Dafalla, Y. M.; Khan, R. U. (2018). The effect of phytogenics on growth traits, blood biochemical and intestinal histology in broiler chickens exposed to Clostridium perfringens challenge**. Journal of applied animal research**, 46(1), 691-695.

BRAZ, N. M.; Fuentes, M. D. F. F.; Freitas, E. R.; Sucupira, F. S.; Moreira, R. F.; Lima, R. C. Semente residual do urucum na alimentação de poedeiras comerciais: desempenho e características dos ovos. **Acta Scientiarum. Animal Sciences**, v. 29, n. 2, p. 129–133, 2007.

CAPITELLI, R. & CROSTA, L. Overview of psittacine blood analysis and comparative retrospective study of clinical diagnosis, hematology and blood chemistry in selected psittacine species. **Veterinary Clinics: Exotic Animal Practice**, v. 16, p.71-120, 2013.

DONG, Z.; Y. WANG; D. SONG; Y. HOU; W. WANG; W. QI; T. YUN, and A. Li. 2016. The effects of dietary supplementation of pre-microencapsulated Enterococcus fecalis and the extract of Camellia oleifera seed on growth performance, intestinal morphology, and intestinal mucosal immune functions in broiler chickens. **Animal Feed Science and Technology**212:42-51.

FARAHAT, M.; F. ABDALLAH; T. ABDEL HAMID, AND A. HERNANDEZ SANTANA. 2016. Effect of supplementing broiler chicken diets with green tea extract on the growth performance, lipid profile, antioxidant status and immune response. **British Poultry Science** 57:714- 722.

FARIA, P.P D.; CRUZ, L. C. F; SAMPAIO, S. A; BORGES, K. F.; MINAFRA, C. S. Análises bioquímicas para frango de corte – revisão. **Revista Eletrônica NutriTime**, v. 18, n: 06, p: 9004-9014, nov/dez 2022.

FERREIRA, D. F. Sisvar; A**. Guide for its Bootstrap procedures in multiple comparisons. Ciência e Agrotecnologia** (UFLA), v. 38, n. 2, p. 109-112, 2014.

Garcia, C.E.R.; Bolognesi, V.J.;Dias, J.F.G.; Miguel, O.G.; Costa, C.K. 2012. Carotenoides bixina e norbixina extraídos do urucum (Bixa orellana L.) como antioxidantes em produtos cárneos. **Ciência Rural** 42(8):1510-1517.

GIULIANO, G.; ROSATI, C.; BRAMLEY, P. M. To dye or not to dye: Biochemistry of annatto unveiled. **Trends in Biotechnology**, v. 21, n. 12, p. 513–516, 2003.

GONZÁLEZ, F. H. D.; SCHEFFER, J. F. S. Perfil sanguíneo: ferramenta de análise clínica, metabólica e nutricional. In: González, F.H.D., Campos, R. (eds.): **Anais do I Simpósio de Patologia Clínica Veterinária da Região Sul do Brasil.** Porto Alegre: Gráfica da Universidade Federal do Rio Grande do Sul. p. 73-89, 2003.

HARR, K. E. Clinical chemistry of companion avian species: a review. **Veterinary Clinical Pathology**, v. 31, p. 140-151, 2002.

KUMAR, S.; KUMARI, R.; MISHRA, S. Pharmacological properties and their medicinal uses of Cinnamomum: a review. **J Pharm Pharmacol**. 2019;71(12):1735-1761.

MINAFRA, C. S.; MARQUES, S. F. F.; STRINGHINI, J. H.; ULHOA, C. J.; REZENDE, C. S. M.; MORAES, G. H. K. Perfil bioquímico do soro de frangos de corte alimentados com dieta suplementada com alfa-amilase de Cryptococcus flavus e Aspergillus niger HM2003. **Revista Brasileira de Zootecnia**, 39: 2691-2696, 2010.

NAZER, A. I.; KOBILINSKY, A; THOLOZAN, J. L; DUBOIS-BRISSONNET, F.; Combinations of food antimicrobials at low levels to inhibit the growth of Salmonella sv. Typhimurium: a synergistic effect?, **Food Microbiology**, v 22, Issue 5, 2005, Pages 391-398, ISSN 0740-0020, https://doi.org/10.1016/j.fm.2004.10.003.

PIRGOZLIEV V.; MANSBRIDGE S.C.; ROSE S. P.; MACKENZIE A. M.; Beccaccia A.; Karadas F.; Ivanova S. G.; Staykova G. P.; Oluwatosin O. O.; Bravo D.; Dietary essential oils improve feed efficiency and hepatic antioxidant content of broiler chickens. **Animal**. 2019;13:502-508.

RAMIREZ, S. Y.; PEÑUELA-SIERRA, L.; M.; OSPINA, M.; A., Effects of orégano (Lippia origanoides) essential oil supplementation on the performance, egg quality, and intestinal morphometry of Isa Brown laying hens. **Vet World** v.14(3); Mar, 2021

ROSTAGNO, H. S.; ALBINO, L. F. T.; HANNAS, M. I.; DONZELE, J. L.; SAKOMURA, N. K.; PERAZZO, F. G.; SARAIVA, A.; ABREU, M. L. T.; RODRIGUES, P. B.; OLIVEIRA, R. F.; BARRETO, S. L. T.; BRITO, C. O. **Composição de alimentos e exigências nutricionais. Tabelas brasileiras para aves e suínos.** 4 Ed.,Viçosa, UFV, 2017.

SILVA, C. R.; GREGGI ANTUNES, L. M.; BIANCHI;, M. DE L. P. Antioxidant action of bixin against cisplatin-induced chromosome aberrations and lipid peroxidation in rats. **Pharmacological Research**, v. 43, n. 6, p. 561–566, 2001.

SILVA, J. P. L.; KRUGER, M. F.; COSTA SOBRINHO, P. S.; SILVA, S. P.; DESTRO, M. T.; LANDGRAF, M.; FRANCO, B. D. G. M. (2005, August). Effects of oregano essential oil and nisin on growth of gram positive and gram negative foodborne pathogens. **In international association for food protection annual meeting** (vol. 92).

ZHANG, C.; FAN, L.; FAN, S.; WANG, J.; LUO, T.; TANG, Y.; CHEN, Z.; YU, L. Cinnamomum cassia Presl: A Review of Its Traditional Uses, Phytochemistry, Pharmacology and Toxicology. **Molecules**. 2019;24(19):3473.

ZHANG, L. X.; COONEY, R. V.; BERTRAM, J. S. Carotenoids enhance gap junctional communication and inhibit lipid peroxidation in C3H/10T1/2 cells: Relationship to their cancer chemopreventive action. **Carcinogenesis**, v. 12, n. 11, p. 2109–2114, 1991.