Acerola byproduct meal for broilers diets: performance and meat characteristics

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Abstract – The purpose of this study was to evaluate the effects of using acerola byproduct meal (AC) in broilers´ diets on the performance of birds and on the rancidity and color of the meat. The experiment had two control groups: a positive one, containing antimicrobial growth promoter and antioxidant but no AC and a negative one, containing no antimicrobial growth promoter, no antioxidant and no AC. The other groups contained AC at 5 and 7.5% total diet but no antimicrobial growth promoter nor antioxidant. The experimental diets did not affect the broilers` performance. Likewise, the color of the breasts and the rancidity of the thighs were not influenced by the addition of AC in the diets.

Key Words – antimicrobial growth promoter, color, rancidity.

I. INTRODUCTION

As a way of keeping high positions in the world ranking of poultry meat exporter, Brazil needs to comply with the rules established by the importer countries, such as the restriction to the use of antibiotics in the feed. Likewise, Brazil stands out in high positions in the market of fruits juice, which provides huge amounts of residues containing bioactive compounds that deserve to find a nobler destination than simply being discarded and so polluting the environment. Moreover, the use of some byproducts of the fruits industry, like the acerola byproduct meal may represent a decrease in the costs with feeding and an increase in productivity. So, the aim of this study was to investigate the effects of using acerola byproduct meal in broilers´ diets on the performance of the birds and on the rancidity and color of the meat.

II. MATERIALS AND METHOD

The experimental diets were formulated with the software PPFR (http://sites.google.com/site/ppfrprogramforfeedformulation/) following the nutritional requirements for broilers [1]. The positive control (PC) diet contained 0.007% colistin sulfate as the antimicrobial growth promoter (AGP), 0.01% butylhydroxytoluene as the antioxidant (BHT) and no acerola meal (AC) while the negative control diet (NC) had no AGP, no BHT and no AC. The other diets contained AC at 5 and 7.5% but no AGP nor BHT (Table 1). One hundred sixty Cobb 500 broilers (4 treatments x 4 replicates) received water and feeds *ad libitum* during 42 days and, after that, three birds from each replicate were slaughtered according to Brazilian sanitary legislation [2]. Feed consumption, animal weight and feed conversion were recorded. The breasts were withdrawn for the analysis of color (T0) at the CIE*Lab* system with a portable MiniScan XE Plus (Hunterlab) and the thighs were withdrawn for the analysis of Thiobarbituric Acid Reactive Substances (TBARS) after 2 days/4°C and 7 days/-20°C [3]. The results were analyzed by ANOVA and Tukey`s test for the multiple comparison of means at 5% significance.

Table 1 – Composition of the experimental diets

	Pre starter			Starter			Grower				Finisher		
Ingredient (%)	PC[1]	NC[2]	PN	NC	AC 5%	AC 7.5%	PC	NC	AC 5%	AC 7.5%	NC/PC[3]	AC 5%	AC 7.5%
Corn (7.88%)	52	52.1	57.5	57.6	48.4	43.8	60.3	60.3	51.2	46.6	73	55.1	50.6
Soybean oil	1.7	1.6	1.9	1.9	4.6	5.9	2.8	2.8	5.5	6.9	0	5.4	6.8
Soybean meal (45%)	42.5	42.5	37.4	37.3	38.9	39.6	34.1	34.1	35.6	36.4	24.6	32.2	32.9
Dicalcium phosphate	1	1	0.7	0.7	0.7	0.7	0.5	0.5	0.5	0.5	0.2	0.3	0.3
Salt	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.4	0.4
AGP[3]	0.007	0	0.007	0	0	0	0.007	0	0	0	0	0	0
L-Lysine HCl	0.2	0.2	0.2	0.2	0.2	0.1	0.2	0.2	0.1	0.1	0.1	0.2	0.1
DL-Methionine	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.1	0.2	0.3
L- Threonine	0	0	0	0	0	0	0	0	0	0	0	0	0
Limestone	1.2	1.2	1	1	0.9	0.9	0.9	0.9	0.8	0.8	0.7	0.8	0.7
Premix[4]	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.3	0.3	0.3
Phytase	0	0	0	0	0	0	0	0	0	0	0	0	0
AC[5]	0	0	0	0	5	7.5	0	0	5	7.5	0	5	7.5
BHT[6]	0.01	0	0.01	0	0	0	0.01	0	0	0	0	0	0
Sand	0	0	0	0	0	0	0	0	0	0	0.5	0	0

Composition													
ME (kcal/kg)	2960	2960	3050	3050	3050	3050	3150	3150	3150	3150	3100	3200	3200
Crude protein (%)	24	24	22.1	22.1	22.6	22.9	20.8	20.8	21.4	21.7	17.3	20.1	20.4
Ca (%)	1	1	0.9	0.9	0.9	0.9	0.8	0.8	0.8	0.8	0.6	0.7	0.7
Total P (%)	0.6	0.6	0.5	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.3	0.4	0.4
Total lysine (%)	1.4	1.4	1.3	1.3	1.3	1.3	1.2	1.2	1.2	1.3	0.9	1.2	1.2
Total methionine (%)	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.4	0.5	0.5
Total threonine (%)	1	1	0.9	0.9	0.9	0.9	0.8	0.8	0.9	0.9	0.7	0.8	0.8
Crude fat (%)	4.3	4.3	4.6	4.6	7.1	8.3	5.6	5.6	8	9.3	3.1	8	9.3
Crude fiber (%)	3.2	3.2	3	3	5.4	6.6	2.9	2.9	5.3	6.5	2.6	5.2	6.4

[1]CP = positive control; [2]NC = negative control; [3]AGP = colistin sulfate; [4]Premix = Polimix Fatec[TM]; [5]AC = acerola meal; [6]BHT = butylhydroxytoluene

III. RESULTS AND DISCUSSION

The experimental diets did not affect the broilers` performance (Table 2). As the sanitary conditions during raising were well controlled, the use of AGP showed to be unnecessary. Also, none of the color attributes (*L*, *a*, *b*, Table 3) was affected due the addition of AC in the diets, what represents a good result since color is an important characteristic for the purchasing decision. Regarding to rancidity, a slight but no significant increase was found with the time of storage in all treatments, as it was expected, since refrigeration and freezing do not avoid the reaction. That represents an important result since the lipid oxidation is harmful to the meat shelf life. However, no effect of the diets on the thighs rancidity was found at any time (Table 4). These results allow the suggestion of using the byproduct from acerola juice production in broilers meal, so diminishing the amount of residues to be discarded by the fruits industry, lowering costs to the industry and bringing benefits to the environment. Since the performance and the meat characteristics were not affected by the inclusion of AC, this practice also could be recommended as a way of lowering feed costs in broilers production.

Table 2 – Daily mean consumption (DMC), mean weight gain (MWG) and feed conversion (FC) of broilers fed acerola meal*

	days	PC[1]	NC[2]	AC 5.0%	AC 7.5%	p value
DMC (kg)	1-7	0.06	0.06	0.05	0.06	0.96
	1-14	0.58	0.59	0.58	0.54	0.829
	1-21	1.35	1.34	1.37	1.4	0.889
	1-28	2.38	2.34	2.41	2.5	0.345
	1-35	3.65	3.65	3.66	3.76	0.726
	1-42	5.21	5.25	5.17	5.23	0.948
MWG (kg)	1-7	0.12	0.12	0.12	0.12	0.787
	1-14	0.39	0.42	0.42	0.42	0.503
	1-21	0.89	0.92	0.94	0.94	0.809
	1-28	1.52	1.52	1.59	1.64	0.326
	1-35	2.28	2.36	2.36	2.44	0.645
	1-42	3.11	3.18	3.22	3.31	0.284
FC (kg)	1-7	0.45	0.45	0.46	0.47	0.909
	1-14	1.48	1.41	1.38	1.4	0.743
	1-21	1.52	1.47	1.45	1.52	0.751
	1-28	1.57	1.54	1.51	1.55	0.755
	1-35	1.6	1.54	1.55	1.55	0.587
	1-42	1.67	1.66	1.61	1.58	0.044

[1]CP = positive control; [2]NC = negative control; [3]AC 5% = acerola meal at 5%; [4]AC = acerola meal at 7,5%. *mean values

Table 3 - Effect of acerola meal on the breast meat color*

Treatments	*L*	*a*	*b*
PC[1]	63.44	5.03	17.02
NC[2]	64.60	5.02	17.20
AC 5%[3]	64.30	4.49	16.62
AC 7.5%[4]	64.12	4.75	16.70
P-value	0.5893	0.2262	0.6546
CV%	3.3039	14.9700	7.5099
MSE	2.1184	0.7218	1.2679

[1]CP = positive control; [2]NC = negative control; [3]AC 5% = acerola meal at 5%; [4]AC = acerola meal at 7,5%; L = lightness; a = redness; b = yellowness; CV = coefficient of variation; MSE = mean square error. *mean values

Table 4 – Lipid oxidation (mg malondialdheyde/g) in the thighs of broilers fed acerola meal*

Treatments	Storage		Mean
	4 °C/2 d	-20°C/7 d	
PC[1]	14.40	16.78	15.59
NP[2]	14.49	16.73	15.61
AC 5%[3]	16.73	18.65	17.69
AC 7.5%[4]	14.68	17.17	15.92
Mean	15.07	17.33	
ANOVA		P-value	
Treatment (Tr)		0.5764	
Time (T)		0.0769	
Tr x T		0.9985	
Cv(%)		21.32	

[1]CP = positive control; [2]NC = negative control; [3]AC 5% = acerola meal at 5%; [4]AC = acerola meal at 7,5%; CV = coefficient of variation. *mean values

IV. CONCLUSION

The use of acerola meal in the broilers diets caused no damage to performance nor to the meat characteristics.

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