NUTRITIONAL FEATURES OF *RHODOCYCLUS GELATINOSUS* BIOMASS PRODUCED IN POULTRY SLAUGHTERHOUSE WASTEWATER

PONSANO, Elisa H. G.[1]; PINTO, Marcos F.[1]; GARCIA-NETO, Manoel [1]; LACAVA, Pedro M.[2]

[1] Universidade Estadual Paulista - Unesp - *Campus* de Araçatuba. P.O. Box 341, Araçatuba, SP, Brazil e-mail: elisahgp@fmva.unesp.br
[2] Universidade Estadual Paulista - Unesp - *Campus* de Araraquara. Araraquara, SP, Brazil

Background

Consumers' search for well-pigmented broilers lead producers to increase the xanthophylls content of rations. In ancient times, the desirable colors for poultry commercialization was assured by the extensive methods of breeding, that included a lot of grass and corn in the feeding and by the non-automatic slaughtering practices used in the processing. Nowadays, intensive breeding systems, genetic selection for fast-growing strains and the use of low fiber content rations led to smaller xanthophylls consumption and, consequently, to lower pigmentation in broiler carcass. Moreover, the industrial processing practices can also affect broilers pigmentation, markedly scald and pick conditions (Marusich & Bauernfeind, 1981; Latscha, 1990). For these reasons, natural and synthetic pigments have been tested in broiler feeds in the last years, in an attempt to augment the xanthophylls levels in rations and, consequently, in poultry products. *Rhodocyclus gelatinosus* biomass produced in poultry slaughterhouse wastewater has shown good results in coloring broilers carcasses when used as feed additive (Ponsano 2000; Ponsano et al., 2002). Nevertheless, the influence of the biomass dietary addition on broilers performance has not been evaluated yet. Once this product contains nutrients others than carotenoids, it may also have a nutritional potential, what deserves a deeper investigation.

Objectives

The aims of this work were to determine the chemical composition of *Rhodocyclus gelatinosus* biomass and to investigate the influence of its dietary inclusion on broilers performance.

Methods

Rhodocyclus gelatinosus biomass was produced in poultry slaughterhouse wastewater and lyophilized (Ponsano, 2000). Biomass moisture, crude protein, lipid and ash contents were determined according to Brasil (1998). Total carbohydrate was found by difference. Amino acid composition was determined by HPLC after cell hydrolysis with HCl 6N at 105°C for 22 hours with post-column reactor, ninhydrin as color reagent and UV detector at 520 nm for the readings. Cobb one-day-old male broiler chicks were raised in a 1.5 x 3.0 m pen equipped with feeders and drinkers, under light heat during the whole day (UV, 250 Watts), from the first to the seventh day. From the eighth to the twenty-first day, birds were allocated in two pens and were light heated during the night. During this first period, chicks were fed starter ration (Tab. 1) and water *ad libitum*. From the twenty-second to the twenty-eighth day, birds were raised in four pens and, from the twenty-ninth to the thirty-fifth day, they were redistributed in 20 pens (6 birds per pen). During this second period, broilers were fed grower ration (Tab. 1) and water *ad libitum*. At the thirty-sixth day, four pens were assigned to each of the five treatments that consisted of different levels of *Rhodocyclus gelatinosus* biomass added to the finisher ration and of a control group, with no biomass supplementation (Tab. 1, 2). Rations were prepared according to NRC recommendations (NRC, 1994). Birds were weighted and the experimental rations were supplied at once (aprox. 1,100 g per broiler) at the thirty-sixth day. At the forty-second day of the experiment, birds and remaining rations were weighted. Performance data investigated included initial weight, final weight, weight gain, feed intake and feed conversion (Torres, 1974). Data were analyzed by ANOVA and means were compared by Duncan Test, according to Snedecor & Cochran (1967).

TABLE 1. Rations composition

Ingredient	%		
	starter ration	grower ration	finisher ration
Sorghum	59.32	50.92	53.94
Soybean meal	33.00	44.80	40.95
Soybean oil	3.90	0.20	0.40
Dicalcium phosphate	1.65	2.00	1.55
Limestone	1.20	1.15	1.45
NaCl	0.267	0.40	1.25
DL methionine	0.235	0.076	0.05
Choline 75%	0.0205	-	-
Yeast	-	0.05	0.0065
Vitamin-mineral premix	0.30	0.40	0.40

TABLE 2. Treatments of the experiment (finisher ration supplementation)

Treatment	*R. gelatinosus* biomass (ppm)
A (control)	-
B	37
C	75
D	150
E	300

Results and Discussion

Lyophilized *R. gelatinosus* biomass showed 7.1% moisture and chemical composition showed in Table 3. The high content of protein found is a typical characteristic of photosynthetic bacteria biomass, signing for a possible use of the product as an ingredient for animal rations formulation. The amino acid profile showed lysine, methionine, glycine, histidine, isoleucine, leucine, phenylalanine, threonine, tryptophan and valine in good proportions in *R. gelatinosus* biomass. According to Andriguetto *et al*. (1988), these amino acids are considered essential to lead to a maximum yield in poultry nutrition. Initial weights did not differ significantly among treatments, what means that all animals started receiving biomass supplementation in similar conditions. The biomass levels used in this experiment did not lead to significantly different final weights. Control group and treatment E, which received the highest biomass supplementation showed the highest weight gains and differed significantly from each other. Treatment E did not differ significantly from treatment F (lowest biomass supplementation) in the weight gain, but differed from the other treatments. The highest feed intake was observed with treatment E (highest biomass supplementation), and was proportionally followed by the other treatments that received biomass, while the control group showed the lowest one. The biomass may have been the responsible for the increase in feed intake due to a flavorizing action. Also for this parameter, treatments E and A differed significantly from each other, although no significant difference was observed among treatment E and the others. Control group and treatment E showed the best feed conversion values and differed significantly from each other. This seems a promising result, which requests further investigation with biomass supplementation levels superior than 300 ppm and/or during a longer time so that the benefits of the product can be best evaluated.

Conclusions

The increase in biomass supplementation caused a proportional increase in feed intake, probably due to a flavorizing action. Although the product has shown an interesting nutritional composition, the supplementation levels and/or the supplementation time seem not to have been enough to alter significantly the broilers performance, once the positive effects appeared mostly at the highest supplementation level (300 ppm). The determination of the chemical and amino acid composition renders feasible to utilize the product as an ingredient, taking place in rations formulation, in order to better evaluate its benefits to broiler performance.

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(to be added if a financial support for the presentation is achieved)

TABLE 3 – Composition of *R. gelatinosus* biomass

Nutrient	%	
	dry weight	wet weight
Moisture	---	7.1
Crude protein	67.6	62.8
Total carbohydrate	27.6	25.6
Lipid	0.6	0.5
Ash	4.2	4.0
amino acid	%	
aspartic acid	5.74	
tyrosine	2.90	
serine	2.63	
glutamic acid	6.85	
proline	3.27	
glycine	4.18	
alanine	6.98	
tryptophan	1.74	
cysteine	0.59	
valine	4.56	
methionine	1.40	
isoleucine	3.18	
leucine	6.80	
threonine	3.52	
phenylalanine	3.03	
lysine	3.61	
histidine	1.83	

TABLE 4. Performance data according to treatments

Treatment	Performance ($x \pm s$)				
	(g)	final weight (g)	weight gain (g)	feed intake (g)	feed conversion (g)
A	1635.00 ± 40.92^{a}	2066.11 ± 57.38^{a}	$431.11 \pm 18{,}28^{a}$	887.33 ± 20.16^{b}	2.06 ± 0.09^{c}
B	1651.67 ± 75.00^{a}	2034.44 ± 60.49^{a}	$382.77 \pm 16{,}86^{b,c}$	$912.61 \pm 21.46^{a,b}$	$2.39 \pm 0.16^{a,b}$
C	1620.55 ± 38.34^{a}	1987.22 ± 35.91^{a}	$366.66 \pm 10{,}92^{c,d}$	$906.38 \pm 5.61^{a,b}$	$2.47 \pm 0.06^{a,b}$
D	1624.44 ± 40.01^{a}	1977.77 ± 35.83^{a}	$353.33 \pm 10{,}00^{d}$	$898.89 \pm 25.25^{a,b}$	2.54 ± 0.02^{a}
E	1628.89 ± 35.99^{a}	2026.11 ± 53.65^{a}	$397.22 \pm 18{,}35^{b}$	925.94 ± 5.67^{a}	2.33 ± 0.08^{b}
	CV (%)				
	2.95	2.46	3.96	1.95	4.19

Means in a column with different superscripts differ significantly ($P < 0.05$)