Utilization of torula yeast grown on distillery's vinasse in starter and growth diets in White Leghorn L-33 replacement layers

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White Leghorn L-33 replacement layers (840 chicks) were used from one until twelve weeks of age distributed according to a completely randomized design, at a rate of 30 birds/cage, in four treatments with seven replications each, with the inclusion of 0, 10, 20 and 30 % of torula yeast, respectively grown on vinasse substrate from alcohol distilleries, in starter (0-42 d) and growth (43-84 d) diets. The inclusion of up to 20 % of vinasse torula yeast during the starter phase allowed a poultry productive performance similar to that of the control group. However, with 30 % it worsened. The 20 % decrease of food consumption determined the lowest live weight (378 vs. 401 g). At 12 weeks of age, birds with 30 % torula yeast maintained a lower live weight (885 vs. 923 g) regarding the control group and at 10 and 20 % torula yeast. Results suggest the inclusion of up to 20 % torula yeast grown on vinasse in the diets for replacement layers during the starter and growth stages.

Key words: *torula yeast, layer replacement, feeding, distillery vinasses*

Genetic development has made possible that presently the laying hen is genetically prepared to start its productive life at earlier ages. In order to attain this objective it is necessary that replacement birds reach adequate live weight during the different rearing phases and, above all, at the beginning of laying period, according to the development of its skeleton (Bermúdez 2000 and Bertechini and de Brito 2007).

Valdivié *et al* (1982) demonstrated the possibility of including up to 20 % torula yeast from sugar cane molasses in starter diets and 17 % in diets until 23 weeks of age. Morales *et al*. (2000) with growing White Leghorn birds reported greater uniformity and superior productive indicators with the use of torula yeast and final sugar cane molasses in the diets.

The objective of this study was to evaluate the productive performance of White Leghorn replacement layers on including torula yeast grown on vinasse substrate from alcohol distilleries in starter and growth diets.

Materials and Methods

The experiment was conducted at the facilities of the Institute of Animal Science. Eight hundred forty replacement White Leghorn (L-33) chicks were used from one until twelve weeks of age. Animals were distributed according to a completely randomized design, at a rate of 30 birds/cage, in four treatments with seven replications each. These consisted of the inclusion of 0, 10, 20 and 30 % of torula yeast, respectively grown on vinasse substrate of alcohol distilleries, in starter and growth diets.

Feeding system applied was by hand and *ad libitum*, according to the recommendations of UECAN (2007): starter (0 to 42 d) and growth (43 to 84 d). Tables 1 and 2 show the experimental diets. The indications regarding beak cutting and illumination regime were applied as established by the technical handbook for this category, as well as the vaccination scheme fixed.

For determining animal performance, weekly food consumption, daily mortality and live weight at the beginning and at six and twelve weeks of age were controlled. From these recordings, feed conversion, viability and lot uniformity in each stage were calculated.

Statistical analysis. Data were processed through variance analysis of simple classification in a completely randomized design. Before applying the ANAVA, the normality of data was verified by Shapiro Wilk test. For the homogeneity of the variance Bartlett test was used. In the necessary cases, differences were ranged according to Duncan (1955). The variable viability was transformed with the arch sine √%, since the suppositions of normality and homogeneity were not fulfilled. The INFOSTAT (Balzarini *et al*. 2001), version 5.1 on Windows XP data computing system was applied.

Table 1. Composition an contribution of the starter diets (1 to 42 days) in HB

Ingredients, %	Torula yeast grown in vinasse, %			
	0	10	20	30
Maize meal	55.13	56.18	57.73	57.56
Soybean cake meal	37.90	28.00	17.82	8.850
Plant oil	2.000	1.500	0.810	0.500
Torula yeast	0.000	10.00	20.00	30.00
Common salt	0.350	0.350	0.350	0.350
DL-methionine	0.100	0.090	0.080	0.060
Monocalcium phosphate	1.690	1.300	0.900	0.550
Calcium carbonate	1.700	1.450	1.180	1.000
Choline	0.130	0.130	0.130	0.130
Premix[1]	1.000	1.000	1.000	1.000
Calculated contribution, %				
ME, MJ/kg	12.13	12.13	12.13	12.13
CP	21.03	21.06	21.00	21.11
Methionine + cystine	0.80	0.80	0.80	0.80
Lysine	1.27	1.37	1.45	1.55

[1]Each kg contains: vitamin A, 13,500 IU; Vitamin D3, 3,375 IU; vitamin E, 34 mg; B2, 6 mg; panthotenic acid, 16 mg; nicotinic acid, 56 mg; Cu, 20 mg; folic acid, 1.13 mg; vitamin B12, 34 µg; Mn, 72 mg; Zn, 48 mg

Table 2. Composition and contribution of the growth diets (43 to 84 days) in HB

Ingredients, %	Torula yeast grown in vinasse, %			
	0	10	20	30
Maize meal	58.00	56.40	56.52	59.35
Soybean cake meal	29.46	19.02	9.050	0.000
Plant oil	1.000	1.000	0.600	0.000
Wheat bran	6.500	9.150	10.00	6.250
Torula yeast	0.000	10.00	20.00	30.00
Common salt	0.350	0.350	0.350	0.350
DL-methionine	0.050	0.050	0.050	0.020
Monocalcium phosphate	1.550	1.150	0.800	0.450
Calcium carbonate	1.960	1.750	1.500	1.100
Choline	0.130	0.130	0.130	0.130
Premix[1]	1.000	1.000	1.000	1.000
Zeolite	0.000	0.000	0.000	1.350
Calculated contribution, %				
ME, MJ/kg	11.92	11.92	11.92	11.92
CP	18.53	18.60	18.55	18.53
Methionine + cystine	0.67	0.67	0.68	0.67
Lysine	1.08	1.17	1.27	1.36

1Each kg contains: vitamin A, 13,500 IU; Vitamin D3, 3,375 IU; vitamin E, 34 mg; B2, 6 mg; panthotenic acid, 16 mg; nicotinic acid, 56 mg; Cu, 20 mg; folic acid, 1.13 mg; vitamin B12, 34 µg; Mn, 72 mg; Zn, 48 mg

Results and Discussion

At six weeks of age, the productive performance of the birds with the inclusion of 10 and 20 % of torula yeast was similar than the control. However, with 30 % it worsened (table 3). These results coincide with what was reported by Valdivié *et al*. (1982), who on evaluating torula yeast of molasses, until 20 % during the starter phase (0-9 weeks of age) of this poultry category did not find effect of the treatment on animal performance.

The disadvantage, with 30 % yeast, can be related to the low nutrient retention attained from 20 % yeast

inclusion (Álvarez and Valdivié 1980, Tillán *et al*. 1986 and Rodríguez *et al*. 2011). This is in correspondence, in turn, with the content of nucleic acids and the high ash content that decreases total nitrogen utilization present in the yeasts, as well as the energy and amino acids in the diet. Another aspect that influenced was the decrease by 20 % of feed consumption in the highest torula yeast level (30 %), regarding the control and the rest of the treatments. This can be associated with the physical form of the feed, since the diet was more pulverized with this level.

Nir *et al*. (1994), Amerah *et al*. (2007) and Pacheco *et al* (2013) observed a decrease in nutrient digestibility when finer particles were employed. This was related to a discreet intestine hypertrophy caused by a bacterial fermentation that, in some way, could affect birds' appetite. The decrease in feed consumption with 30 % yeast influenced on live weight, since food conversion was better than in the control and for 10 and 20 %. This performance was determined by low food consumption and, in consequence, of nutrients what altered feeding efficiency.

Diverse factors such as feed composition and quality, water, vaccines, light and temperature influence on feed consumption (Pérez and López 2004). In this stage, birds are exposed to other stressing processes as beak cutting and vaccines (Jacques 2001). These, in some way, can influence on live weight gain and, thus, in not attaining the standard live weights (450 g/bird).

At the twelfth week, feed consumption, feed conversion, uniformity and viability were not affected by the inclusion of up to 20 % torula yeast in the diet (table 4). While birds with 30 % yeast showed lower live weight (figure 1) and attained 95 % of the established standard (920 g/bird). Concerning this, Hidalgo (2007) stated that birds are below the live weight established for the stage will probably stay like that during the rest of the rearing cycle, what was corroborated in this paper.

Kawakkel *et al*. (1997) stated the importance that pullets attain the live weight at twelve weeks, since in this phase weight is given by the skeleton and organ development, that later will sustain egg production. Likewise, Rodríguez (1989) and Bermúdez (1997) suggested that pullets must attain at twelve weeks of age 95 % of their skeletal development, if it is intended an optimum sexual development for the animal at 18 weeks.

Results reached confirm that higher levels than 20 % yeast in diets for birds affect the productive performance (Butolo 1991 and Perdomo *et al*. 2004). The possibility of including up to 20 % of torula yeast grown on vinasse in diets for White Leghorn L-33 replacement layers allows substituting 69.30 % of the protein in the starter diet and 45.30 % in the growth diet, though it represents an alternative protein feed of home production with perspectives for the feeding of this poultry category.

Table 3. Effect of the inclusion of Cuban vinasse torula yeast on the productive indicators of replacement layers (6 weeks of age)

Indicators	Torula yeast grown on vinasse, %				SE±
	0	10	20	30	
Feed consumption, g/bird	1035.0[b]	1081.0[b]	1093.0[b]	830.0[a]	22.00***
Feed conversion	2.58[b]	2.64[b]	2.75[b]	2.20[a]	0.07***
Viability, %[1]	78.50 (95.13)	81.36 (96.32)	82.51 (97.24)	86.52 (99.11)	0.05
Live weight, g	401.0[b]	409.0[b]	399.0[b]	378.0[a]	4.00***
Uniformity, %	94.45	94.43	93.54	95.13	0.87

( ) Original means

[1]Means transformed by arch sine √%

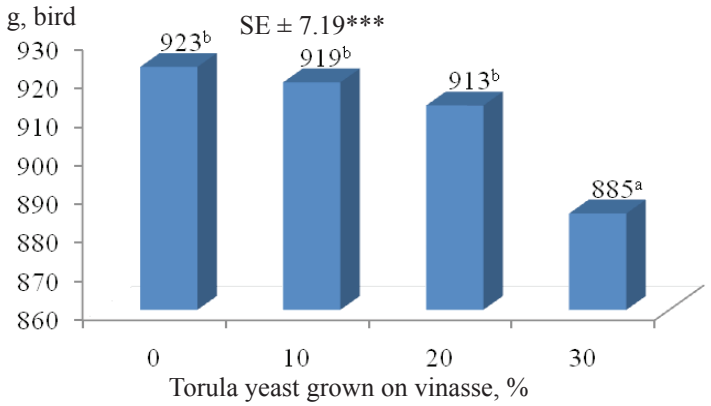
[ab]Different letters in the same row differ significantly at $P < 0.05$ (Duncan 1955)

***$P < 0.001$

Table 4. Effect of the inclusion of vinasse torula yeast on the productive indicators of replacement layers (12 weeks of age)

Indicators	Torula yeast grown on vinasse, %				SE±
	0	10	20	30	
Feed consumption, g/bird	2397.0	2316.0	2346.0	2384.0	58.0
Feed conversion	3.72	3.70	3.77	3.63	0.07
Uniformity, %	93.03	93.65	93.42	94.74	1.02
Viability, %	88.24 (99.48)	86.52 (98.90)	89.38 (100.00)	88.24 (99.50)	0.02

( ) Original means



[ab]Letras desiguales difieren significativamente a P<0.05, ***P<0.001

Figura 1. Efecto de la inclusión de levadura torula de vinaza en el peso vivo de pollitas de reemplazo a 12 semanas de edad

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