BACTERIAL PROBIOTIC ADDITIVE (*PEDIOCOCCUS ACIDILACTICI*) AND ITS IMPACT ON BROILER CHICKENS HEALTH AND PERFORMANCE

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SUMMARY

Antibiotics were very important pieces of the puzzle that enabled the poultry production to move from a backyard flock based industry to the large-scale production facilities of today. Public health professionals have suggested that the use of subtherapeutic antibiotics in animal production may be partially responsible for the development of antibiotic resistant bacterial populations. The probiotics may be substituted by antibiotics (growth promoting) in certain cases. *Pediococcus acidilactici* is a bacterial probiotic used in this experience.16000 broiler chickens were assigned in two experimental groups: treatment (10^9 cfu/kg of feed of *Pediococcus acidilactici* MA18/5M) and control. In each group 8000 broiler chickens were allocated in the same batch and divided by a physical barrier. Individual live weight of a sample of 200 birds for each group from day 0 to day 56 was measured weekly. Feed intake, feed efficiency, mortality, carcass quality, serum lipids (cholesterol and triglycerides) and number of white blood cells, were recorded per group. The administration of *Pediococcus acidilactici* affected positively the growth performance of broilers (2586.43 vs 2252.79 g and feed conversion ratio (2.00 vs 2.5). There were no significant difference between groups in dressing, breast meat and thigh percent, at the end of day 56. Analysis of variance showed significant difference between treatments for serum lipids ($p \leq 0.01$). Mortality was almost similar in both groups (6.56 vs 6.51). The numbers of white blood cells were significantly affected by dietary treatment.

Keywords: *Pediococcus acidilactici*, broiler chickens, performance of production, health

INTRODUCTION

The development of resistance to certain antibiotics poses real problems to the animal and public health (Barton 2000, Hofacre *et al.,* 2001). Consequently, many additives (prebiotics, probiotics, symbiotics…) raise a particular interest as products of substitution to antibiotics in order to improve the production performances and the health of animals (Bach 2001, Revington 2002).

Pediococcus acidilactici is a probiotic bacterium that presents positive effects on the balance and the role of the intestinal flora, it also reinforces the immune defense and improves the production performances of animals (Jin *et al.,* 2000, Coppola and Turnes 2004, Stella 2005).

The objective of this study is to evaluate the effect of addition of *Pediococcus acidilactici* in the feed on the production performances (feed intake, weight gain, feed ratio and carcass yield), and on the blood lipids' concentration and the immunity of broiler chickens.

MATERIALS AND METHODES

1.1. Place of the study

The trial has been conducted at the Poultry Centre of Tazoult (Batna), Algeria. This centre is constituted of 10 buildings having the same technical features (materials of construction, surface area, extractors, pad colling, food and watering chains). Buildings having served to the experimentation have a surface area of 1000 m^2.

1.2. Animals

The trial has been conducted on 16 000 chicks of the strain ISA 15, coming from the same hatchery. They were allocated to two treatment groups of 8000 chicks each (control group and experimental group), raised separately in two identical buildings. Animals have been followed during all the trial period of 56 days of raising (from the 23/02 to 19/ 04/2005). At each weighing, 200 subjects were chosen randomly from both groups for individual weighing.

1.3. Feed

The feed is supplied by the centre of Tazoult that possesses its own unit of feed manufacture. Three types of feed have been distributed according to periods of raising: a starter feed (d0–d21), a grower feed (d22–d42) and a finisher feed (d43–d56). (Table 1)
Two treatments have been compared in this survey:

A control group (Cont.) receiving a classic feed based on maize and soyabean meal and an experimental group (Exp.) fed with the same feed than the (Cont.) combined with 10^9 ufc of Pediococcus acidilactici (MA 18/5M) /kg, equivalent to 100 grams of probiotic per ton of feed. Neither antibiotic, nor anticoccidial has been added to the feed.

1.4. Measured parameters

During the experimental period, feed intake, individual live weight of 200 birds per group, feed ratio and mortality rate have been measured weekly for both treatment groups.

At the end the experimental period 20 chickens from each group have been sacrificed then weighed in order to determine the carcass yield. Two types of yields have been calculated: weight of fat/weight of the carcass and weight of carcass eviscerated/weight of carcass non-eviscerated. The carcass yield permits to measure the probiotic effect on the quality of the carcass.

The number of white blood cells, the serum cholesterol and triglycerides concentration have been determined by blood withdrawals done on 80 chickens chosen randomly from each treatment group.

The statistical analysis has been performed using ANOVA.

RESULTS AND DISCUSSION

1.1. Animal production performance

Results of production performances are summarised in Table 2. The evolution of the live weight of the Experimental group is marked, from the sixth week, by a significantly higher live weight than the Control (1703.67±34.4 vs. 1574.11±33.39 g). The average live weight at the end of the

experimental period is 2586.48 g and 2252.79 g for the (Exp.) and (Cont.) group respectively, which corresponds to an improvement of 12.89%.

These results agree with the works of Cavazonni *et al.*, (1998) and Stella (2005). Kabir *et al*., (2004) observed an improvement of the chickens' weights with other probiotics, however Karaoglu and Dardug (2005) did not establish any effect with *Saccharomyces cerevisiae*.

During all raising phases, chickens having received a supplemented diet with *P. acidilactici* presented feed ratios lower than the Control (Table 3). At the eighth week, chickens of the (Cont.) group had a feed ratio slightly higher than that of the (Exp.) group (2.45 vs. 2.37) respectively. Studies done by Pelicano *et al.,* (2004); Silva *et al.*, (2000); Franco *et al.*, (2005) demonstrated an improvement of the feed ratio with chickens fed on probiotics such as *Bacillus subtilis*, *Lactobacillus acidophilus*, *Saccharomyces cerevisiae* and *Enterococcus faecium*. Johri (2004) did not observe any positive effect on the feed ratio of the chickens when *Streptococcus lactis* was incorporated in the feed.

The mortality rate in the two treatment groups is almost identical (6.57 vs. 6.51). Siwicki *et al.*, (2005), Ramirez (2005) proved a reduction of the mortality rate due to the addition of probiotics in feeds of chickens.

Results concerning the carcass yield and the abdominal fat are summarised in Table 4. There was a clear influence of the use of *P. acididilactici* on the final quality of chickens' carcasses, a significant improvement ($p \leq 0.01$) of the carcass yield is noted (60.40 vs. 66.32%) for (Cont.) and (Exp.) respectively. However there was no significant reduction in the abdominal fat yield for the (Exp.) group in relation to the (Cont.) (1.90 vs. 2.27%). Kalavathy *et al.*, (2003, 2006); Miazzo *et al.*, (2005) observed a significant reduction of the abdominal fat content of the chickens, whereas Pelicano *et al.*, (2004) and Arslan (2004) did not observe any effect of probiotics on the carcass yield of the chickens.

1.2. White blood-cells count

The number of white blood cells has been influenced by the addition of the probiotic in the diet. A significant difference ($p \leq 0.01$) has been observed between the (Cont.) group (25260 ± 3258 /mm^3) and the (Exp.) group (30365 ± 3210 /mm^3). (Table 3)

1.3. Serum lipids concentration

The analysis of serum lipids' concentration of the broiler chickens is summarised in the table 5. The content in lipids of blood that is represented by triglycerides and cholesterol is reduced in a significant manner ($p \leq 0.01$) in the group of chickens receiving *P. acidilactici*, during all raising phases. This could be explained by the fact that probiotics may possess the property of reducing cholesterol in the blood, which is due to the inhibition of the hepatic synthesis of cholesterol, and to their capacity of déconjuguating the biliary salts (Mercenier *et al.*, 2002; Pereira *et al.*, 2003; Lim *et al.*, 2004). On the other hand, Kanashiro *et al.,* (2001) and Djouvinov *et al.*, (2005) did not observe any variations of cholesterol and triglycerides content in chickens' blood while using mixture of different strains of probiotics (*lactobacillus sp, bacillus sp, enterococcus faecium, streptococcus thermophilus*) in the diet.

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Table 1. Composition of the broiler chicken feeds (%)

Ingredients	Starting phase (d0–d21)	Growing phase (d22–d42)	Finishing phase (d43–d56)
Maize	58	60	60
Soyameal	30	25	18
Cereals by-products	9	13	18
CMV*	1.5	1	1
Bicalcic phosphate	1.5	1.5	1.5
Chemical chimique			
ME kcal /kg	3040	3100	3180
Crude protein	21.500	18.500	17.500
Fiber	3.066	2.770	2.536
Ash	7.50	6.20	6.00

*CMV : mineral vitaminic complement

Table 2. Evolution of the live weight (g) of broiler chickens in control and experimental groups

Age (days)	Control group (n= 200)	Experimental group (n =200)	P
0	46.11±0.20	44.08± 0.25	NS
14	241.88± 3.33	245.45± 3.61	NS
28	802.36± 15.06	842.97± 21.44	NS
42	1574.11± 33.39	1703.67± 34.4	*
56	2252.79± 24.50	2586.43± 27.6	*

NS : not significant
*($p \leq 0.01$)

Table 3. Feed ratio, mortality rate, number of white blood cells of the broiler chickens in control and experimental groups at day 56

	Control group	Experimental group	P
Feed ratio	2.45	2.37	NS
Mortality rate %	6.57	6.51	NS
Number of white blood cells (n/mm^3)	25260±3258	30365±3210	*

Table 4. Carcass yield of broiler chickens in the control and experimental groups

	Control group (n=20)	Experimental group (n=20)	P
Live weight (g)	2285.57± 48.00	2629.90±45.20	*
Carcass weight (g)	1715.56±38.80	2091.84± 44.90	*
Carcass yield (%)	60.40	66.32	*
Fat weight (g)	37.36±5.66	39.92±4.42	NS
Fat Yield (%)	2.27	1.9	NS

NS : Not significant
* : ($p \leq 0.01$)

Table 5. Serum lipids' concentration in the of broiler chickens in the control and experimental groups

Parameters		Ages (n=80)				P
		d14	d28	d42	d56	
Cholesterol (g/l)	Exp.	1.10± 0.06	0.94± 0.09	0.93± 0.05	0.84± 0.09	*
	Cont.	1.20± 0.01	1.13± 0.01	0.96± 0.12	1.09± 0.11	
Triglycerides (g/l)	Exp.	1.42 ±0.07	1.23± 0.04	0.86± 0.08	0.84 ±0.06	*
	Cont.	1.46± 0.09	1.25± 0.10	1.15 ±0.03	0.86 ±0.06	

NS : Not significant
*: ($p \leq 0.01$)