

# Aluminium Intake Impact on Broiler Chickens During a Production Cycle on Some Bioproductive Parameters

Mărioara Drugă<sup>1</sup>, Alexandra Trif<sup>2</sup>, Mihai Drugă<sup>1</sup>, Ducu Ștef<sup>1</sup>, Ana Driha<sup>3</sup>

<sup>1</sup> Banat's University of Agricultural Sciences and Veterinary Medicine, Faculty of Food Processing Technology, Calea Aradului 119, RO-300645, Timisoara, Romania

<sup>2</sup> Banat's University of Agricultural Sciences and Veterinary Medicine, Faculty of Veterinary Medicine, Calea Aradului 119, RO-300645, Timisoara, Romania

<sup>3</sup> Banat's University of Agricultural Sciences and Veterinary Medicine, Faculty Animal Sciences and Biotechnology, Calea Aradului 119, RO-300645, Timisoara, Romania

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## Abstract

The study was carried out on broiler chickens divided in 3 experimental groups (E<sub>1</sub>, E<sub>2</sub>, E<sub>3</sub>), fed during 7 weeks with a diet containing 20, 70 and 200 ppm Al, as aluminium oxide/ DM of the ration, and a control group. The goal of the study was to evaluate the effect of dietary aluminium oxide on some bioproductive parameters (daily and weekly medium weight gain, daily medium feed consumption and feed conversion rate). Conclusions: excepting E<sub>3</sub> group, both daily and weekly medium weight gain were inferior to control group; daily medium feed consumption was lower on experimental groups than on control group and feed conversion rate was slightly higher on experimental groups than on control group.

**Key words:** aluminium, broiler chickens, bioproductive parameters.

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## 1. Introduction

Aluminium metal is found almost everywhere: in water, animal tissue, and plant tissue, in addition to the earth's crust, where it is the most abundant metal. [1, 2] The body does not have a biological requirement for aluminum, but the ubiquity of the metal means that a small intake of dietary aluminum is unavoidable. This low-level aluminum intake is not harmful, but high concentrations of the metal can be extremely toxic. Aluminum toxicity is a rare condition, but can occur in certain specific situations. When aluminum accumulates in the body, it can result in organ dysfunction and serious health problems. [3] The main aluminium source for animals is represented by dietary intake (feed and water).

The goal of the study was to evaluate the aluminium intake impact on broiler chickens on some bioproductive parameters (daily and weekly medium weight gain, daily medium feed consumption and feed conversion rate (FC).

The objective was to estimate the consequences of cumulative aluminium oxide intake impact during a production cycle of broiler chicken on mentioned bioproductive parameters.

## 2. Materials and methods

For the evaluation of aluminium oxide intake impact on bioproductive parameters the study was carried out on 40 broilers H. ISA - HUBBARD divided in 4 experimental groups (E) and in one control group (C). The poultry were fed with standard feed, corresponding to their age, divided in three phases: starter (0-7 days); grower (22-35 days) and finisher (36-49 days) and watered *ad libitum*. The experimental groups E<sub>1</sub>, E<sub>2</sub> and E<sub>3</sub>,

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\* Corresponding author: Mărioara Drugă, Email: [mary\\_druga@yahoo.co.uk](mailto:mary_druga@yahoo.co.uk)

each of 10 individuals received into diet during 7 weeks, as follows:

- ◆ E<sub>1</sub> 20 ppm Al/DM of the ration;
- ◆ E<sub>2</sub> 70 ppm Al/DM of the ration;
- ◆ E<sub>3</sub> 200 ppm Al/DM of the ration.

Aluminium source was aluminium oxide. The 20 and 70 ppm Al/DM of the ration represents dietary levels found in hens' diet in aluminium industry surrounding areas, at 0.5-1 km, respectively 6.5-7 km away the factory and 200 ppm is the maximum tolerable level for poultry [4].

The weight of the chickens and the consumption of feed were determined weekly till the end of the production cycle in order to determine daily and weekly medium weight gain, daily medium feed consumption and feed conversion rate (FC). The weight was determined at the same time of day and at the same order of groups.

### 3. Results and discussion

Daily medium weight gain (d.m.w.g) (grams) and weekly medium weight gain (w.m.w.g.) (grams) consecutive aluminium oxide intake at control and experimental groups (E<sub>1</sub>, E<sub>2</sub>, E<sub>3</sub>) are summarized in table 1 and the dynamics of these parameters is presented in figure 1.

Daily medium weight gain and weekly medium weight gain, both to control and experimental

groups increased till fifth week, than slightly decreased in sixth and seventh weeks.

Comparing to control group, the differences in experimental groups (E<sub>1</sub>, E<sub>2</sub> and E<sub>3</sub>) didn't exceed ±10%.

Excepting E<sub>3</sub> group (+6.5%) daily and weekly medium weight gain compared to the others experimental groups were inferiors to those registered on control group (E<sub>1</sub>: -0.69%, E<sub>2</sub>: -6.48%).

Increasing aluminium level intake determined the decrease of daily and weekly medium weight gain (E<sub>2</sub>/E<sub>1</sub>: -5.83%) excepting E<sub>3</sub> group who received the higher dose of aluminium oxide (E<sub>3</sub>/E<sub>2</sub>: +11.34%, E<sub>3</sub>/E<sub>1</sub>: +6.84%).

Daily medium feed consumption during all raising period is presented in table 2 and in figure 2.

Daily medium feed consumption appreciated during all raising period was lower on experimental groups comparing to control group (average E<sub>1</sub>+E<sub>2</sub>+E<sub>3</sub>/C: - 16.47%).

Increasing aluminium level intake determined limited decrease of daily medium feed consumption (variations between -7.28 and -2.06%).

Feed conversion rate (FC) during experimental period (0 – 7 weeks) is presented in table 3.

**Table 1.** Daily medium weight gain (g) and weekly medium weight gain (g) consecutive aluminium oxide intake in broiler chickens

Week experiment	Specification							
	E <sub>1</sub>		E <sub>2</sub>		E <sub>3</sub>		C	
	d.m.w.g.	w.m.w.g.	d.m.w.g.	w.m.w.g.	d.m.w.g.	w.m.w.g.	d.m.w.g.	w.m.w.g.
1	11,66	81,67	12,69	88,89	14,04	98,33	14,44	101,12
2	22,54	157,78	18,88	132,22	26,98	188,89	22,22	155,55
3	36,82	257,78	31,11	217,78	42,22	295,55	38,57	270,00
4	46,85	328,00	61,14	428,00	61,30	429,12	54,63	382,45
5	57,14	400,00	61,14	428,00	62,57	438,00	66,28	464,00
6	54,00	378,00	50,28	352,00	53,14	372,00	42,85	300,00
7	55,71	390,00	32,85	230,00	44,00	308,00	47,71	334,00
Average/total experim. period	40,67	284,74	34,29	268,127	43,46	304,24	40,95	286,73

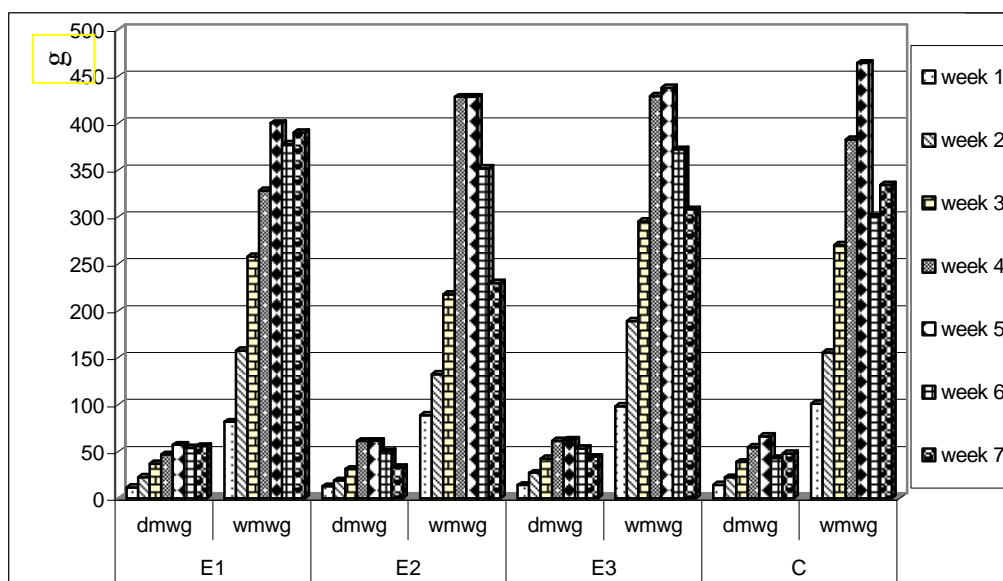


Figure 1. Medium daily and weekly weight gain (g) dynamics consecutive aluminium oxide intake in broiler chickens

Table 2. Daily medium feed consumption consecutive aluminium oxide intake in broiler chickens

Experimental week	E <sub>1</sub>	E <sub>2</sub>	E <sub>3</sub>	C
1	15,08	13,97	13,49	15,08
2	43,81	34,13	48,41	37,14
3	53,97	57,94	44,44	51,43
4	138,09	142,98	144,68	160,85
5	136,86	130,86	138,86	186,57
6	141,14	124,86	135,43	192,29
7	124,86	95,14	111,71	135,14
Average/total raise period	81,23	75,31	79,21	94,08

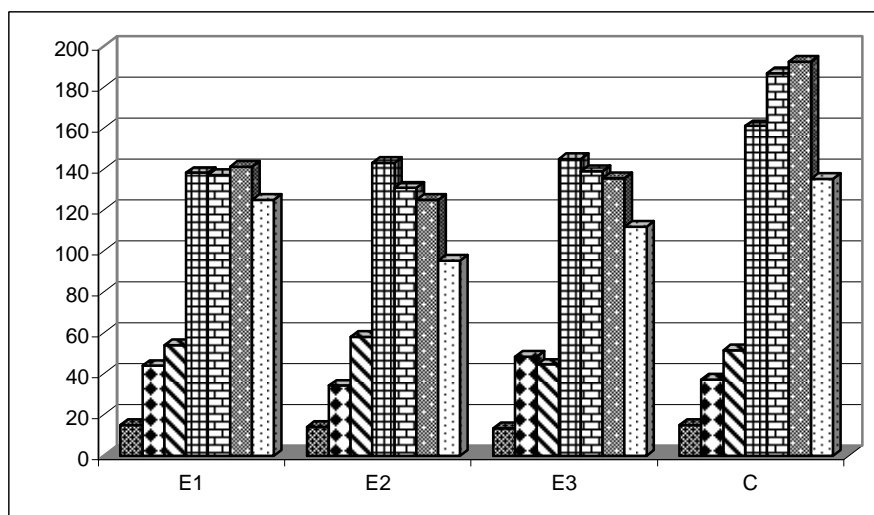


Figure 2. Daily medium feed consumption (g) dynamics consecutive aluminium oxide intake in broiler chickens

**Table 3.** Feed conversion rate (FC) consecutive aluminium oxide intake

Experimental period	E <sub>1</sub>	E <sub>2</sub>	E <sub>3</sub>	C
0-7 weeks	2175,10	2403,14	2067,35	2091,27

As it can be observed from presented data, feed consumption/kg weight gain was by 5.92% higher on experimental groups (average E/C %) than on control group.

Increasing aluminium dietary intake determined limited increase of feed consumption/ kg weight gain in case of dietary increasing from 20 ppm to 70 ppm Al/DM of the ration (+9.4%) and decrease, also limited, when dietary level increase from 70 to 200 ppm Al/DM of the ration (-13.98%) and from 20 to 200 ppm Al/DM of the ration (-4.96%).

Similar findings were reported by Sallam et al.[5] who realized an experiment with rabbits treated by aluminium chloride and which caused significant decrease in live body weight and feed intake as compared to control. The decrease in live body weight and feed intake of animals treated with AlCl are in agreement with the finding of Pettersen *et al.*,[6] Llobet *et al.*[7] and Bataineh *et al.*[8] Also, Albina *et al.* [9]found that rabbits treated with increasing doses of aluminium showed decrease in body weight gain. Also, Gomez *et al.* found that treatment with aluminium in drinking water with increasing doses for 6.5 month, caused decreased in body weight of rats. Cherroret *et al.*[10] suggested that the reduction in body weight of treated young rats with aluminium chloride for 5 to 14 days could be attributed to the decrease in feed consumption.

#### 4. Conclusions

Researches concerning consequences of dietary intake during 7 weeks (between maximum admitted limits: 20, 70 and 200 ppm aluminium/DM of the ration) as aluminium oxide, on some bioproductive parameters on broiler chickens emphasized:

1. Limited daily and weekly medium weight gain decrease, correlated to aluminium dietary intake increase (excepting 200 ppm / DM of the ration level);
2. Limited decrease of daily medium feed consumption, correlated to aluminium dietary intake increase;

3. Slightly increase of feed conversion rate, correlated to aluminium dietary intake increase (excepting 200 ppm / DM of the ration level).

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