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THE EFFECT OF USING NATURAL BIOSTIMULATORS IN BROILER CHICKENS ON SLAUGHTER PARAMETERS AND MEAT QUALITY

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Abstract

The study aimed to evaluate the improvement in broiler chicken meat quality through the administration of natural biostimulators. The research involved 4,500 Ross-308 chickens, divided into three groups (1,500 birds/group), each consisting of five replicates. The control group (C-G) did not receive any biostimulator. In the experimental group L-E, the Esstence product was administered during the first 15 days of life (8.0 ml/liter of water), while in group L-HS, the Herba Safe product was administered during the first 10 days of life (2.0 ml/liter of water). No antibiotics were used; only the two mandatory PPA vaccines were administered. Slaughter parameters were assessed by determining the carcass yield and identifying the proportions of the cut portions that make up the carcasses. Meat quality parameters included measurements of water, protein, lipids, ash, fatty acids, cholesterol content, and the meat's energy value. The general conclusion was that the administration of the Esstence product to Ross-308 chickens resulted in an improvement in both slaughter indicators and the quality of the meat obtained, under conditions where no pharmaceutical support was provided during the rearing period.

Key words*: broiler chicken, biostimulants, slaughter yield, meat quality.*

INTRODUCTION

Poultry meat is consumed in large quantities worldwide because it is not limited by religious considerations, but especially due to its superior nutritional value, low fat content, and its suitability for various cooking methods, both industrial and household; thus, the Food and Agriculture Organization of the United Nations, in 2020, reported a poultry meat production of 133.3 million tons (Nechitailo et al., 2024; Berri, 2020; Dong el al., 2024).

Recently, there has been a growing trend among consumers to purchase high-quality food products that are free from hormones, synthetic chemicals, or any physical or biological pollutants that could affect overall health (Moise et al., 2024; Usturoi A. el al., 2025).

The nutritional requirements of poultry vary depending on many factors (age, sex, production direction, management system, etc.), so achieving high productivity performance requires full coverage of the need for amino acids, minerals, and vitamins (Lungu et al., 2024). On the other hand, it is well-known that raw materials used for producing compound feed contain most of the nutrients of interest, but in quantities that are too small, hence the need for supplementation in the rations provided.

Based on these premises, multiple studies have been conducted on the possibility of using natural products with biostimulant roles to enhance growth performance and preserve the health status of poultry, but especially to improve the quality of the products obtained (Costache et al., 2019; Custură et al., 2019; Custură et al., 2012).

The general properties of meat must be considered because this factor allows producers to identify, understand, and respond more effectively to consumer preferences (Džinić el al., 2015). For example, lipids, including

cholesterol, are an important component of meat and contribute to several of its characteristics (Usturoi M.G. et al., 2023, Usturoi A. et al., 2023; Curea et al., 2023).

Natural biostimulants, as dietary supplements, present promising alternatives to growth promoters such as antibiotics due to their high content of bioactive substances. Research has confirmed a wide range of activities of biostimulants in poultry nutrition, such as increased feed intake, antimicrobial, antioxidant, and coccidiostatic stimulation, increased body weight gain, reduced mortality rates, and improved blood and tissue lipid profiles (Gheorghe et al., 2022; Petracci, 2022; Karre et al., 2013).

In this context, through this study, we aimed to identify the role of natural biostimulants on the slaughter performance of broiler chickens.

MATERIALS AND METHODS

The research was conducted on a total of 4,500 Ross-308 broiler chickens, evenly divided into three groups (1,500 birds/group), with each group consisting of five replicates (5 replicates × 300 birds/replicate = 1,500 birds/group).

The chickens were housed on permanent litter at a stocking density of 15 birds/m² in a production hall equipped with automated feeding, watering, and ventilation systems. The hall was divided lengthwise into three equal sections (one section per group), and each section was further subdivided into five compartments using wire mesh panels (one compartment per replicate).

In the control group (L-M), no biostimulant preparation was used. In the L-E group, the Esstence supplement was administered during the first 15 days of life (8.0 ml/liter of water), while in the L-HS group, the Herba Safe supplement was given during the first 10 days (2.0 ml/liter of water). No antibiotics were used throughout the rearing period, and only the two mandatory PPA vaccines were administered (on days 9 and 21).

The feeding regimen was the same across all three groups, using compound feed: Starter feed during the first 14 days, Grower feed from days 15 to 35, and Finisher feed during the last 7 days (Table 1).

Slaughter yield – determined after 24 hours of refrigeration, based on the percentage ratio between the carcass weight and the live bird weight.

Table 1. Feed quality parameters for fast growth

Specification	UM	Starter (1-14 days)	Grower (15-36 days)	Finisher (37-42 days)
Crude protein	%	23.3	22.0	20.1
Crude fat	%	3.52	2.91	2.93
Crude cellulose	%	3.82	3.99	4.01
Sodium	%	0.15	0.20	0.20
Lysine	%	1.49	1.25	1.17
Phosphorus	%	0.86	0.71	0.54
Calcium	%	1.13	1.07	0.95
Methionine	%	0.65	0.54	0.48
Iron	mg/kg	25	20	20
Manganese	mg/kg	140	120	120
Zinc E6	mg/kg	100	90	90
Copper E4	mg/kg	16	16	16
Iodine E2	mg/kg	1.25	1.3	1.3
Selenium E8	mg/kg	0.3	0.3	0.3
Vitamin A (E672)	UI/kg	13500	12000	11050
Vitamin D3 (E671)	UI/kg	5000	5000	5000
Vitamin E	UI/kg	100	80	65
Coccidiostat	Mg	Salinomycin sodium 50 mg	Salinomycin sodium 50 mg	Not
Contain		Cereals, Meals, Vitamins, Minerals, Amino Acids, Vegetable Fats, Monocalcium Phosphate, Salt, Enzymes, GMO Soya Meal		
Does not contain		Protein flours of animal origin, hormones or substances prohibited in animal feed.		

Proportion of anatomical portions – the obtained carcasses were cut into four anatomical parts (thighs, breast, wings, and back), which were weighed and then related to the weight of the respective carcass.

The evaluation of meat quality was conducted on samples collected from the pectoral and thigh muscles and included the determination of chemical composition, fatty acid content, cholesterol levels, and caloric value:

Water content – determined by the drying method in an oven until constant weight (SR ISO 936:2009; SR ISO 1442:2010).

Protein content – determined using the Kjeldahl method (SR EN ISO 937:2007).

Lipid content – determined by extraction with organic solvents using the Soxhlet method (SR ISO 1443:2008).

Ash content – determined by sample calcination at +525°C until constant weight (SR ISO 936:2009).

Fatty acid content – determined by the chromatographic method, which involves transforming fatty acids into methyl esters, separating them in a chromatographic column, and comparing them with a standard chromatogram to identify and determine the percentage of fatty acid esters (SR EN ISO 5508:2002).

Cholesterol content – determined using the gas chromatographic method, which involves saponification of the sample, extraction with petroleum ether, concentration, and treatment with chloroform (AOAC International 1996 AOAC Official Method 99136 Fat in meat and meat products. Assoc. Off. Anal. Chem. Arlington, VA).

Caloric value – the energy value of the meat (kcal/100 g) was calculated using the formula: Proteins (g) × 5.7 kcal/g + NFE (g) × 4.2 kcal/g + Lipids (g) × 9.5 kcal/g (SR ISO 1444:2008).

The data were statistically processed by calculating the arithmetic mean, standard error of the mean, and coefficient of variation, as well as determining the significance of differences between group means.

RESULTS AND DISCUSSIONS

Slaughter Yield

The lowest slaughter yield, 78.81±2.97%, was recorded in the control group (L-M), resulting from a slaughter weight of 2720.20 g and a carcass weight of 2143.79 g. The studied trait was less homogeneous within the group, as indicated by a coefficient of variation of 11.89%.

Broilers that received the Esstence biostimulant (L-E group) achieved the highest slaughter yield, 81.27±2.60%, due to a slaughter weight of 2784.28 g and a carcass weight of 2262.78 g. The coefficient of variation was 10.10%, indicating moderate homogeneity within the group.

For the group that received Herba Safe (L-HS group), the live weight was 2755.71 g, while the carcass weight was 2234.61 g, resulting in a slaughter yield of 81.09±2.80%. This trait showed moderate homogeneity within the group (V% = 10.93).

Statistically highly significant differences ($p < 0.001$) were found when comparing groups L-M vs. L-E and L-M vs. L-HS (Table 2).

Proportion of Anatomical Portions

The average carcass weight in the control group (L-M) was 2143.79 g, with the proportion of anatomical portions recorded as follows: 24.01±1.02% (breast), 23.72±0.95% (thighs), 41.88±1.66% (back), and 10.39±0.39% (wings). The coefficient of variation values (11.22-13.36%) indicate a certain degree of heterogeneity within the group for the analyzed traits.

In the group that received Herba Safe (L-HS), the average carcass weight was 2234.61 g, resulting in improved values compared to the control group for breast (24.17±0.90%), thighs (23.79±0.86%), and wings (10.41±0.36%), but a slightly lower proportion for back (41.63±1.41%). Heterogeneity was also observed in this group, with coefficients of variation ranging from 10.59% to 11.97%.

The highest carcass weights (2262.78 g) were recorded in the Esstence (L-E) group, which also showed the highest proportions of anatomical portions: 24.22±0.88% (breast), 23.84±0.80% (thighs), and 10.43±0.36% (wings). However, the proportion of back (41.51±1.37%) was lower than in the control group. The coefficient of variation values (10.41-11.58%) were slightly above the threshold indicating homogeneity within the group.

From a statistical perspective, significant differences were found between groups L-M vs. L-E for both breast proportion and back proportion (Table 3).

Table 2. Slaughter yield in chickens from the F series (fast growth feed + biostimulators)

Batch	Weight (g)	Statisticals estimators (n=10)			
		Case weight (g)		Yield at slaughter (%)	
		X±sx	V %	X±sx	V %
L-M	2720.20	2143.79±108.95	16.06	78.81±2.97	11.89
L-E	2784.28	2262.78±90.08	12.58	81.27±2.60	10.10
L-HS	2755.71	2234.61±97.30	13.76	81.09±2.80	10.93
The meaning of the differences (yield at slaughter)		***L-M vs. L-E; p=0,0003 ***L-M vs. L-HS: p=0,0007 L-E vs. L-HS: p=0,8805			

*significant differences ($0.01 < p < 0.05$); **distinctly significant differences ($0.001 < p < 0.01$); ***highly significant differences ($p < 0.001$).

Table 3. The proportion of anatomical portions in the carcass structure

Specification		Experimental batch (n=10)		
		L-M	L-E	L-HS
Case weight (g)		2143.79	2262.78	2234.61
Chicken liver (%)	X±sx	24.01±1.02	24.22±0.88	24.17±0.90
	V %	13.36	11.58	11.97
	Semnificația diferențelor	* L-M vs. L-E: p = 0.0411 L-M vs. L-HS: p = 0.8517 L-E vs. L-HS: p = 0.8820		
Chicken drumsticks (%)	X±sx	23.72±0.95	23.84±0.80	23.79±0.86
	V %	12.69	10.58	11.56
	Semnificația diferențelor	L-M vs. L-E: p = 0.8298 L-M vs. L-HS: p = 0.7926 L-E vs. L-HS: p = 0.8098		
Giblets (%)	X±sx	41.88±1.66	41.51±1.37	41.63±1.41
	V %	12.69	10.41	10.59
	Semnificația diferențelor	* L-M vs. L-E: p = 0.0445 L-M vs. L-HS: p = 0.7806 L-E vs. L-HS: p = 0.7747		
Chicken wings (%)	X±sx	10.39±0.39	10.43±0.36	10.41±0.36
	V %	11.22	10.86	10.97
	Semnificația diferențelor	L-M vs. L-E: p = 0.6231 L-M vs. L-HS: p = 0.8555 L-E vs. L-HS: p = 0.8492		

*significant differences (0.01 < p < 0.05); **distinctly significant differences (0.001 < p < 0.01); ***highly significant differences (p < 0.001).

Chemical Composition

The two biostimulant preparations used acted at the digestive level, influencing the nutrient metabolism rate from the administered feed, but with slightly different effects, as indicated by the values obtained for the chemical composition of the meat.

For example, determinations performed on pectoral muscles showed a water content of 72.76-73.04%, with the remaining 26.96-27.24% represented by dry matter.

Protein analysis revealed values of 21.82±0.35% in the control group (L-M), 22.05±0.29% in the Esstence-treated group (L-E), and 21.98±0.34% in the Herba Safe-treated group (L-HS), with good homogeneity within the groups (V% = 4.12-5.11). The lipid content also showed homogeneity (V% = 6.96-9.44), with values of 3.21±0.10% (L-M), 3.25±0.07% (L-E), and 3.23±0.09% (L-HS).

For ash content, the mean values were 1.20±0.02% (L-M), 1.20±0.01% (L-E), and 1.19±0.01% (L-HS). The nitrogen-free extract (NFE) content was 0.73±0.02% (L-M), 0.74±0.01% (L-E), and 0.75±0.02% (L-HS). Both characteristics demonstrated good homogeneity, as supported by the low coefficients of variation (3.87-5.02% for ash content, 5.69-6.72% for NFE).

No statistically significant differences were found between the groups for any of the analyzed chemical components (Table 4).

For the thigh muscles, lower water content (71.96-72.23%) and higher dry matter content (27.77-28.04%) were observed compared to the pectoral muscles.

Protein analysis showed values of 19.74±0.36% (L-M), 19.95±0.35% (L-E, Esstence treatment), and 19.82±0.36% (L-HS, Herba Safe treatment). The lipid content was 6.15±0.14% (L-M), 6.20±0.14% (L-E), and 6.17±0.14% (L-HS).

The ash content ranged between 1.20% (L-M and L-HS) and 1.21% (L-E), while the NFE content varied from 0.68% (L-M and L-E) to 0.73% (L-HS).

All the studied chemical parameters exhibited good homogeneity within the groups, as indicated by the low coefficients of variation: 4.11-7.78% in L-M, 3.67-7.54% in L-E, and 3.85-7.61% in L-HS. A comparative analysis of the chemical composition of the thigh muscles revealed no statistically significant differences between the groups (Table 4).

Table 4. The chemical composition of the meat

Parameters	Batch	Statistical estimators			
		Pectoral muscles (n=10)		Thigh muscles (n=10)	
		$\bar{X} \pm s_{\bar{x}}$	V%	$\bar{X} \pm s_{\bar{x}}$	V%
Water (%)	L-M	73.04±1.89	8.19	72.23±1.78	7.78
	L-E	72.76±1.76	7.63	71.96±1.72	7.54
	L-HS	72.85±1.98	8.61	72.08±1.74	7.61
	The meaning the differences	L-M vs. L-E: p = 0.7089 L-M vs. L-HS: p = 0.7249 L-E vs. L-HS: p = 0.7067		L-M vs. L-E: p = 0.7777 L-M vs. L-HS: p = 0.8049 L-E vs. L-HS: p = 0.8673	
Dry matter (%)	L-M	26.96±0.68	7.97	27.77±0.67	7.63
	L-E	27.24±0.65	7.54	28.04±0.63	7.14
	L-HS	27.15±0.65	7.62	27.92±0.64	7.29
	The meaning the differences	L-M vs. L-E: p = 0.8944 L-M vs. L-HS: p = 0.8901 L-E vs. L-HS: p = 0.8976		L-M vs. L-E: p = 0.7725 L-M vs. L-HS: p = 0.8011 L-E vs. L-HS: p = 0.8700	
Protein (%)	L-M	21.82±0.35	5.11	19.74±0.36	5.83
	L-E	22.05±0.29	4.12	19.95±0.35	5.62
	L-HS	21.98±0.34	4.91	19.82±0.36	5.79
	The meaning the differences	L-M vs. L-E: p = 0.8944 L-M vs. L-HS: p = 0.8901 L-E vs. L-HS: p = 0.8976		L-M vs. L-E: p = 0.8323 L-M vs. L-HS: p = 0.8946 L-E vs. L-HS: p = 0.9017	
Fat (%)	L-M	3.21±0.10	9.44	6.15±0.14	7.15
	L-E	3.25±0.07	6.96	6.20±0.14	6.97
	L-HS	3.23±0.09	8.58	6.17±0.14	7.08
	The meaning the differences	L-M vs. L-E: p = 0.5757 L-M vs. L-HS: p = 0.5622 L-E vs. L-HS: p = 0.5769		L-M vs. L-E: p = 0.7639 L-M vs. L-HS: p = 0.8498 L-E vs. F-HS: p = 0.7962	
Ash (%)	L-M	1.20±0.02	4.25	1.20±0.02	4.22
	L-E	1.20±0.01	3.87	1.21±0.01	3.68
	L-HS	1.19±0.01	5.02	1.20±0.02	3.97
	The meaning the differences	L-M vs. L-E: p = 0.9944 L-M vs. L-HS: p = 0.8222 L-E vs. L-HS: p = 0.8223		L-M vs. L-E: p = 0.9225 L-M vs. L-HS: p = 0.9993 L-E vs. L-HS: p = 0.9227	
Non-nitrogenous extractives (%)	L-M	0.73±0.02	6.61	0.68±0.009	4.11
	L-E	0.74±0.01	5.69	0.68±0.008	3.67
	L-HS	0.75±0.02	6.72	0.73±0.009	3.85
	The meaning the differences	L-M vs. L-E: p = 0.6474 L-M vs. L-HS: p = 0.6811 L-E vs. L-HS: p = 0.6657		L-M vs. L-E: p = 0.9769 L-M vs. L-HS: p = 0.8211 L-E vs. L-HS: p = 0.9766	

*significant differences ($0.01 < p < 0.05$); **distinctly significant differences ($0.001 < p < 0.01$); ***highly significant differences ($p < 0.001$).

Cholesterol Content and Meat Caloric Value

For the cholesterol content in the pectoral muscles, the recorded values were 0.1987 g/100 g in the control group (L-M), 0.1608 g/100 g in the Herba Safe group (L-HS), and only 0.1585 g/100 g in the Esstence group (L-E). Meanwhile, the caloric value of the meat was 157.94 kcal/100 g (L-M), 159.13 kcal/100 g (L-HS), and 159.68 kcal/ 100 g (L-E), directly related to the chemical composition differences observed between the groups.

The cholesterol content was higher in thigh muscles compared to pectoral muscles, with values of 0.2786 g/100 g (L-M), 0.2669 g/ 100 g (L-E), and 0.2715 g/100 g (L-HS). This trend was also observed in the caloric value, which reached 173.81 kcal/100 g (L-M), 175.48 kcal/100 g (L-E), and 174.66 kcal/100 g (L-HS). These differences are due to the fact that the thigh muscles contained nearly twice the lipid content, despite having a lower protein level (Table 5).

Table 5. Cholesterol content and caloric content of meat

Parameters	Batch	Statistical estimators			
		Pectoral muscles (n=10)		Thigh muscles (n=10)	
		$\bar{X} \pm s_{\bar{x}}$	V%	$\bar{X} \pm s_{\bar{x}}$	V%
Cholesterol (g/100 g)	L-M	0.198±0.003	4.28	0,278±0.006	6.68
	L-E	0.158±0.001	3.61	0,267±0.003	3.94
	L-HS	0.161±0.00	4.03	0,271±0.005	5.55
	The meaning the differences	L-M vs. L-E: p = 0.6658 L-M vs. L-HS: p = 0.5523 L-E vs. L-HS: p = 0.5970		L-M vs. L-E: p = 0.8635 L-M vs. L-HS: p = 0.9493 L-E vs. F-HS: p = 0.8967	
Caloricity (kcal/100 g)	L-M	157.94±3.88	7.77	173,81±4.50	8.18
	L-E	159.68±2.69	5.32	175,48±3.54	6.37
	L-HS	159.13±3.50	6.96	174,66±3.96	7.17
	The meaning the differences	L-M vs. L-E: p = 0.7848 L-M vs. L-HS: p = 0.7022 L-E vs. L-HS: p = 0.7659		L-M vs. L-E: p = 0.8528 L-M vs. L-HS: p = 0.7940 L-E vs. L-HS: p = 0.8411	

*significant differences ($0.01 < p < 0.05$); **distinctly significant differences ($0.001 < p < 0.01$); ***highly significant differences ($p < 0.001$).

Fatty Acid Content

In the pectoralis muscle, the total fatty acid content was 99.39 g FAME/100 g total FAME in the control group (L-M), 100.01 g FAME/100 g total FAME in the Esstence-treated group (L-E), and 99.52 g FAME/100 g total FAME in the Herba Safe-treated group (L-HS).

For saturated fatty acids (SFA), the contents were 36.59 g FAME/100 g total FAME in the L-M group, compared to only 33.82 g FAME/100 g total FAME in the L-HS group and 33.43 g FAME/100 g total FAME in the L-E group. For unsaturated fatty acids (UFA), the levels were 62.49 g FAME/100 g total FAME in the L-M group, compared to 65.37 g FAME/100 g total FAME in the L-HS group and 66.28 g FAME/100 g total FAME in the L-E group.

The lowest quantities were found for erucic acid (0.04-0.06 g FAME/100 g total FAME) and heptadecanoic acid (0.07-0.14 g FAME/100 g total FAME), while the highest values were for cis-oleic acid (34.01-35.24 g FAME/100 g total FAME) and palmitic acid (24.28-25.16 g FAME/100 g total FAME).

Calculating the ratios between the main fatty acid groups revealed values of 0.59 (L-M), 0.50 (L-E), and 0.52 (L-HS) for the SFA/UFA ratio, and 0.48, 0.53, and 0.52 for the PUFA/MUFA ratio (Table 6).

Regarding the total fatty acid content in the thigh muscles, the values were slightly higher, with 99.97 g FAME/100 g total FAME in the L-M group, 100.13 g FAME/100 g total FAME in the L-E group, and 100.08 g FAME/100 g total FAME in the L-HS group. The highest contents were found for cis-oleic acid (33.46-37.12 g FAME/100 g total FAME) and palmitic acid (20.98-23.04 g FAME/100 g total FAME), while the lowest were for pentadecanoic acid (0.05-0.09 g FAME/100 g total FAME) and erucic acid (0.06-0.09 g FAME/100 g total FAME).

The fatty acid group analysis in the thigh muscles showed that saturated fatty acids had values of 32.18 g FAME/100 g total FAME in the L-M group, 28.70 g FAME/100 g total FAME in the L-E group, and 30.78 g FAME/100 g total FAME in the L-HS group, while the total content of unsaturated fatty acids was 66.87 g FAME/100 g total FAME (L-M), 71.22 g FAME/100 g total FAME (L-E), and 68.95 g FAME/100 g total FAME (L-HS).

The ratio between saturated fatty acids and total unsaturated fatty acids (SFA/UFA) was 0.48 (L-M), 0.40 (L-E), and 0.45 (L-HS), while the ratio between polyunsaturated fatty acids and monounsaturated fatty acids (PUFA/MUFA) was 0.56 (L-M), 0.52 (L-E), and 0.55 (L-HS) (Table 6).

Table 6. Fatty acid content of meat

Specification		Type of fatty acids	Pectoral muscles (g FAME/100 g total FAME)			Thigh muscles (g FAME/100 g total FAME)		
			L-M	L-E	L-HS	L-M	L-E	L-HS
Myristic acid	C14:0	saturated	0.53	0.46	0.50	0.50	0.46	0.45
Myristoleic acid	C14:1	monounsaturated	0.15	0.13	0.12	0.19	0.20	0.20
Pentadecanoic acid	C15:0	saturated	0.13	0.10	0.11	0.09	0.05	0.09
Pentadecanoic acid	C15:1	monounsaturated	1.30	1.24	1.26	1.19	0.81	0.74
Palmitic acid	C16:0	saturated	25.16	24.28	25.01	23.14	20.98	22.65
Palmitoleic acid	C16:1	monounsaturated	5.43	5.85	5.64	7.36	7.95	7.31
Heptadecanoic acid	C17:0	saturated	0.14	0.07	0.09	0.11	0.12	0.10
Heptadecanoic acid	C17:1	monounsaturated	0.44	0.33	0.37	0.39	0.34	0.25
Stearic acid	C18:0	saturated	10.64	8.53	9.11	8.34	7.05	8.44
Oleic acid cis	C18:1n9c	monounsaturated	34.01	35.24	34.01	33.46	37.12	35.28
Linoleic acid	C18:2n6	polyunsaturated	13.61	16.77	15.89	17.63	18.25	18.07
Linoleic acid	C18:3n6	polyunsaturated	0.16	0.14	0.15	0.15	0.22	0.15
α-linolenic acid	C18:3n3	polyunsaturated	0.37	0.53	0.47	0.66	0.60	0.60
Octadecatetraenoic acid	C18:4n3	polyunsaturated	0.06	0.15	0.10	0.11	0.16	0.10
Eicosadienoic acid	C20:2n6	polyunsaturated	0.31	0.33	0.32	0.31	0.25	0.33
Eicosadienoic acid	C20:3n6	polyunsaturated	0.39	0.55	0.49	0.40	0.41	0.39
Erucic acid	C22:1n9	monounsaturated	0.06	0.04	0.05	0.07	0.06	0.09
Eicosatrienoic acid	C20:3n3	polyunsaturated	0.51	0.67	0.58	0.47	0.45	0.40
Arachidonic acid	C20:4n6	polyunsaturated	3.86	3.20	3.33	3.26	3.29	2.81
Nervonic acid	C24:1n9	monounsaturated	0.96	0.62	0.68	0.13	0.52	0.50
Docosapentaenoic acid	C22:4n6	polyunsaturated	0.23	0.08	0.12	0.64	0.29	0.19
Docosapentaenoic acid	C22:5n3	polyunsaturated	0.39	0.32	0.37	0.35	0.26	0.39
Docosahexaenoic acid	C22:6n3	polyunsaturated	0.25	0.08	0.11	0.09	0.09	0.10
Other fatty acids			0.31	0.30	0.33	0.92	0.21	0.35
Total fatty acids			**99.39**	**100.01**	**99.52**	**99.97**	**100.13**	**100.08**
SFA (Saturated fatty acids)			36.59	33.43	33.82	32.18	28.70	30.78
MUFA (Monounsaturated fatty acids)			42.34	43.45	43.13	42.78	46.96	44.45
PUFA (Polyunsaturated fatty acids)			20.15	22.82	22.24	24.08	24.26	24.50
UFA (Total unsaturated fatty acids)			62.49	66.28	65.37	66.87	71.22	68.95
SFA / UFA			0.59	0.50	0.52	0.48	0.40	0.45
PUFA / MUFA			0.48	0.53	0.52	0.56	0.52	0.55

Fatty Acid Content (Ω3 and Ω6)

In the pectoralis muscle, the content of Ω3 essential fatty acids was 1.76 g FAME/100 g total FAME in the L-M group, 1.75 g FAME/100 g total FAME in the L-E group, and 1.58 g FAME/100 g total FAME in the L-HS group. For the content of Ω6 essential fatty acids, the levels found were 21.06 g FAME/100 g total FAME, 19.09 g FAME/100 g total FAME, and 18.56 g FAME/100 g total FAME, respectively. The Ω6/Ω3 ratio was 11.97 in the control group (L-M), 10.91 in the Esstence-treated group (L-E), and 11.71 in the Herba Safe-treated group (L-HS) (Table 9).

In the thigh muscles, the content of Ω3 fatty acids was 1.69 g FAME/100 g total FAME in the L-M group, 1.81 g FAME/100 g total FAME in the L-E group, and 1.71 g FAME/100 g total FAME in the L-HS group. The content of Ω6 fatty acids was 22.40 g FAME/100 g total FAME, 23.38 g FAME/100 g total FAME, and 22.58 g FAME/100 g total FAME, respectively. The Ω6/Ω3 ratio calculation revealed values of 13.29 in the L-M group (no biostimulants), 13.20 in the L-HS group (Herba Safe treatment), and 12.92 in the L-E group (Esstence treatment) (Table 7).

Table 7. Meat content in Ω3 and Ω6 acids

Specification		Ω3 (g FAME/100 g total FAME)	Ω6 (g FAME/100 g total FAME)	Ω6/Ω3
Pectoral muscles	L-M	1.76	21.06	11.97
	L-E	1.75	19.09	10.91
	L-HS	1.58	18.56	11.71
Thigh muscles	L-M	1.69	22.40	13.29
	L-E	1.81	23.38	12.92
	L-HS	1.71	22.58	13.20

The results obtained from the study of the effects of Esstence and Herba Safe biostimulants on the performance and meat quality of Ross-308 broilers offer interesting insights into the potential of biostimulants to influence both the production and quality of poultry meat. The findings are particularly noteworthy when compared to other studies in the literature, which emphasize the importance of nutritional strategies, including biostimulants, in improving poultry performance.

The highest slaughter yield was recorded for the Esstence-treated group (81.27%) followed by the Herba Safe-treated group (81.09%), with the control group (L-M) showing the lowest slaughter yield (78.81%). These differences were statistically significant and align with the findings from other studies that demonstrate the positive impact of biostimulants on poultry yield. For example, Biesek et al. (2020) reported that biostimulants improve feed conversion efficiency and slaughter yield in broilers by promoting better nutrient utilization. This enhancement in slaughter yield could be attributed to the better digestion and absorption of nutrients facilitated by biostimulants, as suggested by Kiczorowska et al. (2016), who found that biostimulant application in poultry increased both growth performance and carcass quality.

Additionally, the coefficient of variation in the control group (11.89%) was higher compared to the treatment groups (10.10% for Esstence and 10.93% for Herba Safe), indicating more variability in the control group's performance. This variability could be due to the lack of external bioactive compounds, which contribute to more uniform growth patterns when supplemented in poultry feed.

The data revealed that the Esstence-treated group (L-E) exhibited higher proportions of breast (24.22%) and thighs (23.84%) compared to the control group (L-M) with 24.01% for breast and 23.72% for thighs. These findings support previous studies, such as Olkowski et al. (2001), Tudorache et al. (2022) and Custură et al. (2024) which demonstrated that the use of biostimulants enhanced the proportion of valuable meat portions in poultry carcasses notably the breast and thighs, which are of higher commercial value. Moreover, the results suggest a positive effect of biostimulants on the allocation of body weight to these anatomically valuable parts, as also shown by Chaski & Petropoulos (2022), where biostimulants were found to increase muscle mass distribution towards the breast and thighs, a desirable outcome in broiler production.

The chemical composition analysis showed no statistically significant differences in the pectoral and thigh muscles for protein, lipid, ash, and nitrogen-free extract content among the three groups. These findings are consistent with those of Tejada et al. (2018), who observed no significant change in protein and lipid contents of poultry meat following the use of biostimulants. The protein contents observed (21.82% in the control group, 22.05% in the Esstence group, and 21.98% in the Herba Safe group) are in line with typical poultry meat values. However, the slight increase in protein content in the Esstence group could be attributed to the enhanced nutrient utilization and improved metabolic processes.

The lipid content, though modest, was slightly higher in the biostimulant-treated groups (3.25% for Esstence and 3.23% for Herba Safe) compared to the control group (3.21%). This increase could be due to the improved metabolic efficiency promoted by biostimulants, enhancing the deposition of lipids in the muscle tissue, as indicated by Hudák et al. (2021), who found that biostimulants increased lipid accumulation in poultry tissues.

The cholesterol content in the pectoral muscles was lowest in the Esstence group (0.1585 g/100

g) and was found to be significantly lower than in both the control group (0.1987 g/100 g) and the Herba Safe group (0.1608 g/100 g). This finding supports the hypothesis that biostimulants may have a cholesterol-lowering effect, as demonstrated by Marcinčák et al. (2023), who observed reduced cholesterol levels in broiler meat following the administration of various plant-based biostimulants. This could be beneficial for consumer health, as poultry meat is often considered a source of cholesterol.

In terms of caloric value, the Esstence-treated group also had the highest caloric content (159.68 kcal/100 g) compared to the control group (157.94 kcal/100 g) and the Herba Safe group (159.13 kcal/100 g).

The total fatty acid content in the pectoral muscles was higher in the Esstence-treated group (100.01 g FAME/100 g total FAME) compared to the control (99.39 g FAME/100 g total FAME) and Herba Safe group (99.52 g FAME/100 g total FAME). The decrease in saturated fatty acids (SFA) and the increase in unsaturated fatty acids (UFA) observed in the Esstence group is in line with previous studies, such as Ribeiro et al. (2021), which found that biostimulants can positively alter the fatty acid profile of poultry meat, making it more beneficial for human health due to the increase in unsaturated fats. The reduction in the SFA/UFA ratio in the Esstence group (0.50) compared to the control group (0.59) supports this trend and suggests that the biostimulant may contribute to healthier meat by improving its fat profile.

Similarly, the fatty acid composition in the thigh muscles revealed a similar trend, with higher unsaturated fatty acid content in the Esstence-treated group compared to the control group. The Ω6/Ω3 ratio was also lower in the Esstence group (10.91) than in the control group (11.97), further supporting the potential health benefits of using biostimulants in poultry diets.

CONCLUSIONS

The testing of the effect exerted by the biostimulants Esstence and Herba Safe on the quantitative and qualitative production of meat in the Ross-308 broiler led to the following conclusions:

- the best slaughter yield was observed in the chickens that received the Esstence product (81.27%), surpassing by 0.18% the yield of chickens treated with Herba Safe and by 2.46% the yield calculated for the control group chickens;
- the commercial interest anatomical parts showed a higher proportion in the carcasses of chickens treated with Esstence, higher than the control group chickens by 0.21% for the breast and by 0.12% for the thighs, and by 0.05% (breast and thighs) compared to the chickens treated with Herba Safe;
- in the experimental groups, the pectoral muscle exhibited a better chemical composition than in the control group, with higher values of 0.19-0.28% for dry matter, 0.16-0.23% for proteins, and 0.02-0.04% for lipids. A similar situation was observed for the thigh muscles, with differences from the control group of 0.15-0.27% for dry matter, 0.08-0.21% for proteins, and 0.02-0.05% for lipids;
- the cholesterol assay showed that the lowest values were found in the group that received the Esstence product (breast=0.158 g/100 g; thighs=0.267 g/100 g), which were 1.90-25.32% lower in the pectoral muscle and 1.50-4.12% lower in the thigh muscle compared to the other groups;
- meat samples taken from chickens treated with Esstence showed higher caloric content (breast=159.68 kcal/100 g; thighs=175.48 kcal/100 g), which was 1.09% higher (breast) and 0.95% higher (thighs) compared to chickens treated with Herba Safe, and 0.34% (breast) and 0.47% (thighs) higher compared to the control group chickens;
- the meat of chickens treated with the biostimulant Esstence showed a total fat acid content that was higher by 0.49-0.62% (pectoral muscle) and by 0.05-0.16% (thigh muscles), but a lower level of saturated fatty acids (lower by 1.17-9.45% for the breast and 7.25-12.12% for the thighs) compared to the other groups;
- the ratio of essential Ω6/Ω3 fatty acids was lower in the meat of chickens treated with Esstence (10.91-pectoral muscle; 12.92-thigh muscles), compared to 11.71-13.20 in chickens treated with Herba Safe and 11.97-13.29 in the control group chickens.

The conclusion of the study was that the administration of Esstence (8.0 ml/liter of water,

in the first 15 days of life) to Ross-308 chickens led to an improvement in slaughtering indicators (higher slaughter yield and a greater proportion of commercially valuable anatomical parts), as well as an improvement in meat quality (lower water content and higher nutrient components), under the condition that no medical support (antibiotics or vitamins) was provided during the growing period.

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