EFFECTS OF SOME FEED ADDITIVES ON BIOPRODUCTIVE AND BIOCHEMICAL INDICES OF BLOOD SERUM IN BROILERS

LAVINA STEF, CALIN JULEAN, DAN DRINCEANU, MARIA NICULA, DRAGOS FOTA, DUCU STEF, IOAN PET

Banat's University of Agricultural Sciences and Veterinary Medicine, Faculty of Animal Science and Biotechnologies, Timisoara, Calea Aradului No. 119, 300645
lavi_stef@yahoo.com

ABSTRACT - Effects of some feed additives on bioproductive and biochemical indices of blood serum in broilers
Previous researches proved the effects exerted by a mixture of mint (*Mentha Piperita*), savory (*Thymus vulgaris*) and sage (*Salvia officinalis*) essential oils on broiler health, due to their antibacterial, antifungal and antiviral action, and also the stimulation of the digestive secretions. To enhance the bioproductive effect of the essential oil mixture 0.05%, we associated to this an acidifying mixture consisted of calcium propionate and calcium formate 0.03% in the experimental variant (V2); in the third experimental variant, beside the same essential oil doses and acidifying substances, we added 0.45% of a probiotic *Bacillus subtilis* and *Bacillus licheniformis*-based preparation. Compared with the reference variant (V1), the association of essential oils with acidifying substances (V2) does not influence the feed ingestion, but we may obtain a significantly bigger body weight ($p<0.05$), with 8.86%, and the reduction of the specific intake with 6.60%. In the variant V3, where the essential oils were associated with acidifying substances and probiotics, the feed intake has not been obviously changed, but the body weight grew significantly bigger ($p<0.05$), with 9.97%, and the specific intake got reduced with 6.1% compared with V1. The cholesterol level was not influenced by phyto-additives and neither by the association with acidifying substances and probiotics. The triglycerides got significantly reduced ($p<0.05$), with 44.45%, successive to the addition of acidifying substances to essential oils, and with 41.53% in the case of addition of acidifying substances and probiotics to the essential oils, compared with the reference variant.
Keywords: broiler, phyto-additives, acidifying substances, probiotics

INTRODUCTION

The researches carried out by ŞTEF LAVINA ET AL. 2007, 2008, 2009, with different phyto-additives, proved the effect of these on the maintenance of animal health status and implicitly on the improvement of animal productivity.
To ensure broiler health status in terms of antibacterial, antifungal and antiviral effect, and also from the viewpoint of digestive secretion stimulation (LEE ET AL. 2003) (MENCINICOPSCHI ET AL. 2009), we studied a mixture of essential oils of mint (*Mentha Piperita*), savory (*Thymus vulgaris*) and sage (*Salvia officinalis*), administrated in dose of 0.05% of feed. The medicinal plant utilization and of essential oils in broiler chicken diet stimulates the caecal mucous, generating an hypertrophic process manifested by glandular apparatus development, through capillary net hypertrophy and leucocytic infiltrate stimulation, with role in local defending (ŞTEF LAVINIA ET AL. 2009).
Because the phyto-additives' direct effect on the productive indices is less obvious on the whole, during this research we studied the possibility to enhance this effect by associating it with acidifying substances and probiotics.
Of the acidifying substances, we selected the Calcium propionate and the Calcium formate, which, according to (LUCKSTADT ET AL. 2004) may significantly influence broiler body

weight at 1 week, and also the feed ingestion. Beside the antibacterial effect with the reduction of diarrhoea cases, acidifying substances also improve the digestive utilization of feed by increasing weight growths and reducing the specific intake in broilers (CORCIONIVOSCHNI AND DRINCEANU, 2009).
Probiotics, through *Bacillus subtilis* and *Bacillus licheniformis*, may exert productive effects in broilers on the improvement of growth performances (SANTOSO et al. 2001) and, from this point of view, it was useful to associate them with the phyto-additives studied.

MATERIAL AND METHOD

The biological material used in this experiment was represented by 90 broiler chickens, belonging to the hybrid ROSS 308, feed with the combined feed (1 - 21 days CP 22.94%, ME 3198 kcal, 22 - 42 days CP 19.97%, ME 3176 kcal) and distributed according to the general organization scheme of the experiment (*table 1*) in three variants, as follows:
- V_1 fed combined feed (CF) including essential oils in dose of 0.05%;
- V_2 fed on CF with incorporation of essential oil mixture 0.05% and acidifying mixture 0.30%;
- V_3 fed CF with incorporation of essential oils and acidifying substances in the same proportion and addition of probiotic preparation 0.45%.

To reveal the productive effect of these feed preparations, we determined the following indices: feed ingestion, body growth and the feed conversion index, at the ages of 3 and 6 weeks old.
At the end of the experimental period, we determined the following biochemical indices of the blood serum: triglycerides and cholesterol. The determinations were performed with the analyzer Fully Vet.

Table 1. General organization scheme of the experiment

Specification	Experimental variant		
	V1	**V2**	**V3**
n	30	30	30
Experimental period	42 days	42 days	42 days
Basic feed	CF	CF	CF
Nutritional factors of variation: feed additives	• ***Essential oils 0.05%:*** -mint oil -savory oil -sage oil	• ***Essential oils 0.05%:*** -mint oil -savory oil -sage oil • ***Acidifying substances 0.03%*** -Ca propionate -Ca formate	• ***Essential oils 0.05%:*** -mint oil -savory oil -sage oil • ***Acidifying substances 0.03%*** -Ca propionate -Ca formate • ***Probiotic: 0.45%*** *- Bacillus subtilis* *- Bacillus licheniformis*
Indices determined:			
-bioproductive indices		-feed ingestion -body weight -body growth -FCR	
-sanguine biochemical indices		-triglycerides -cholesterol	

RESULTS

The first index studied was represented by feed intake evolution, presented in *table 2.* according to this table, we may observe that, during the period 0-3 weeks, in the variants with addition of acidifying substances (V_2) and acidifying substances and probiotics (V_3), there was the tendency of increasing the combined feed ingestion (with approximately 5%); this tendency was not available anymore during the growth period 4-6 weeks, so that the values become constant for the entire experimental period, when we may notice that, in V_2, the CF intake was 1.79% bigger than in V_1, and in V_3, 3.46% bigger than in V_1.

Table 2. Feed intake evolution in chickens from the experimental variants

Specification	Experimental variant		
	V1	**V2**	**V3**
	Period 1 day -3 weeks		
CF intake/period/chicken (kg/chicken)	1038.55	1097.80	1090.84
Mean daily intake (cmz)(g)	49.45	52.27	51.94
Percentage differences	**100**	**105.70**	**105.03**
	Period 4-6 weeks		
CF intake/period/chicken (kg/chicken)	3326.97	3345.80	3426.12
Mean daily intake (cmz)(g)	158.42	159.33	163.14
Percentage differences	**100**	**100.57**	**102.97**
	Period 1 day -6 weeks		
CF intake/period/chicken (kg/chicken)	***4365.52***	***4443.60***	***4516.96***
Mean daily intake (cmz)(g)	***103.94***	***105.8***	***107.54***
Percentage differences	***100***	***101.79***	***103.46***

Table 3. presents the data representing body weight evolution during the two growth periods (0-3 weeks; 4-6 weeks), respectively during the entire experimental period (0-6 weeks).

Until the age of 3 weeks, the association of acidifying substances to essential oils determine in chickens from V_2 a body weight increase with 6.92% bigger than in V_1, with a significant difference ($p<0.05$) between the two indices.

Successive to the addition of probiotics to the essential oils and acidifying substances in the feed administrated, in V_3, the weight of 807.2±15.8g places the group at a significant difference ($p<0.05$) compared with V_1 and insignificant ($p>0.05$) compared with V_2.

The better start of the chickens in V_2 and V_3, compared with V_1, as regards the chicken weight during the period 0-3 weeks, is maintained at comparable percentage differences at the end of the experimental period, becoming 8.86% compared with 6.92% in V_2/ V_1 and 9.97 % compared with 8.27 % in V_3/V_1.

Table 3. Body weight evolution in chickens from the experimental variants

Specification	Experimental variant		
	V1 (n=30)	**V2 (n=30)**	**V3 (n=30)**
Weight at eclosion (g)	39	40	39
	Period 1 day -3 weeks		
Body weight at 3 weeks ($\bar{x} \pm Sx$)	745.5^{a}±16.4	797.1^{b}±16.9	807.2^{b}±15.8
Percentage differences	**100**	**106.92**	**108.27**
CV	9.09	8.72	8.29
Total growth/period	706.5	757.1	768.2
smz	33.64	36.05	36.58
	Period 4-6 weeks		
Body weight at 6 weeks ($\bar{x} \pm Sx$)	2255.0^{a}±58.1	2455.0^{b}±67.1	2480.6^{b}±60.0
Percentage differences	**100**	**108.86**	**109.97**
CV	10.30	10.93	9.98
Total growth/period	1509.5	1697.9	1712.4
smz	71.88	80.85	81.54
	Period 1 day - 6 weeks		
Body weight at 6 weeks ($\bar{x} \pm Sx$)	***2255.0^{a}±58.1***	***2455.0^{b}±67.1***	***2480.6^{b}±60.0***
Total growth/period	***2216.0***	***2415.0***	***2441.6***
smz	***52.76***	***57.5***	***58.14***

*there are not any significant differences between the means with the same index ($p>0.05$)
^{a,b} –$p<0.05$

The data regarding feed conversion ratio (FCR), expressed as kg CF/kg growth, are presented in *table 4*. The values of this index are differentiated compared with the control variant (V_1) especially during the second growth period (4-6 weeks), when the specific intake in V_2 is 10.46% more reduced compared with V_1, and in V_3 it is smaller with 9.10% compared with V_1.

During the entire experimental period, the specific intake in the reference group (V_1) was 1.97; in V_2, fed feed including essential oils with addition of acidifying substances, the index got reduced with 6.60%; in V_3, whose CF contained essential oils, acidifying substances and probiotics, the index got reduced with 6.10% compared with V_1.

Of the sanguine biochemical indices, in this experiment we dosed the cholesterol and triglycerides from the serum taken from 6 chickens from each experimental variant.

Regarding the cholesterol, according to the data presented in *table 5*., we may conclude that neither the phyto-additives, nor in association with acidifying substances or probiotics influence significantly this index's value.

According to the literature (PÂRVU ET AL. 2003), the serum cholesterol level in 7-week old chickens is 105±15; the content means obtained in V_1 and V_3 belong to this interval and the higher level in V_2 is not influenced by the feed ingredients, but especially by individual poultry characteristics.

Table 4. Specific intake evolution in chickens from the experimental variants

Specification	Experimental variant		
	V1	V2	V3
	Period 1 day -3 weeks		
CF intake/period/chicken (kg/chicken)	1038.55	1097.80	1090.84
Growth/period/chicken (g)	706.5	757.1	768.2
FCR (kg feed/kg growth)	1.47	1.45	1.42
Percentage differences	**100**	**98.63**	**96.60**
	Period 4-6 weeks		
CF intake/period/chicken (kg/chicken)	3326.97	3345.80	3426.12
Growth/period/chicken (g)	1509.5	1697.9	1712.4
FCR (kg feed/kg growth)	2.20	1.97	2.00
Percentage differences	**100**	**89.54**	**90.90**
	Period 1 day -6 weeks		
CF intake/period/chicken (kg/chicken)	***4365.52***	***4443.60***	***4516.96***
Growth/period/chicken (g)	***2216.0***	***2415.0***	***2441.6***
FCR (kg feed/kg growth)	***1.97***	***1.84***	***1.85***
Percentage differences	***100***	***93.40***	***93.90***

Table 5. Biochemical indices of blood serum in broilers (mg/100 ml)

Specification	Reference values	Experimental variant		
		V1	V2	V3
Cholesterol	105±15	104.50^{a}±1.57	117.50^{a}±9.17	104.00^{a}±4.02
Percentage differences		**100**	**112.4**	**99.52**
Triglycerides	60±20	85.50^{a}±2.91	47.50^{b}±5.14	50.00^{b}±8.05
Percentage differences		**100**	**55.55**	**58.47**

*there are not any significant differences between the means with the same index ($p>0.05$)
^{a,b} –$p<0.05$

In the case of triglycerides, in the reference variant, their value of 85.50±2.91 overtakes a little the maximal value presented in the literature, respectively 60±20 (PÂRVU ET AL. 2003); on the contrary, by adding acidifying substances in V_2, triglycerides' concentration significantly decreases ($p<0.05$) with 44.45%. In the case of the addition of acidifying substances and probiotics, the concentration gets reduced with 41.53% ($p<0.05$).

CONCLUSIONS

The association to the mixture of phyto-additives (essential oils) of acidifying substances and probiotics influences the bioproductive indices and the biochemical indices of blood serum in broilers as follows:

* Compared with the reference value (V1), the association between essential oils and acidifying substances (V2) does not influence feed ingestion, but we may obtain a

significantly bigger body weight ($p<0.05$), with 8.86%, with the specific intake reduction of 6.60%;
*In variant V3, where the essential oils were associated with acidifying substances and probiotics, the feed intake did not obviously change, but the body weight was significantly higher ($p<0.05$), with 9.97%, with the specific intake reduction of 6.1% compared with V1;
* The cholesterol was not influenced by phyto-additives by themselves and neither in association with acidifying substances and probiotics;
* The triglycerides got significantly reduced ($p<0.05$), with 44.45%, successive to the addition of acidifying substances to the essential oils, and with 41.53% successive to the addition of acidifying substances and probiotics to the essential oils, compared with the reference value.

REFERENCES

CHEN K.L., KHO W.L., YOU S. H., YEH R.-H., TANG S.- W. AND HSIEH C.W. (2009): Effects of Bacillus subtilis var. natto and Saccharomyces cerevisiae mixed fermented feed on the enhanced growth performance of broilers Poult Sci. 88:309-315

CORCIONIVOSCHI N., DRINCEANU D. (2009): Probioticele la timpul prezent. Editura Mirton, Timisoara

LEE K.W., EVERTS H., KAPPERT H.J., FREHNER M., LOSA R., BEYNEN A.C. (2003): Effects of dietary essential oil components on growth performance, digestive enzymes and lipid metabolism in female broiler chickens. Br Poult Sci.Jul;44 (3):450-7

LÜCKSTÄDT, C., SENKÖYLÜ, N., AKYÜREK, H. AND AGMA, A. (2004): Acidifier – a modernalternative for anti-biotic free feeding in livestock production, with special focuson broiler production. Veterinarija ir Zootechnika 27: 91–93

MENCINICOPSCHI GEORGHE, BOJOR OVIDIU, IONESCU-CALINESTI LARISA (2009): Compendiu de terapie naturala, Editura: Medicala Bucuresti

PARVU GHE., COSTEA MIHAELA, PIRVU MARIUS, NICOLAE BOGDAN (2003): Tratat de nutritia animaleleor, Editura Coral Sanivet, Bucuresti

SANTOSO U., TANAKA K., OHANIAND S., AND SAKSIDA M. (2001): Effect of fermented product from *Bacillus subtilis* on feed efficiency, lipid accumulation and ammonia production in broiler chicks. Asian-Australas. J. Anim. Sci. 14:333–337

STEF LAVINIA, DUMITRESCU GABI, DRINCEANU D., STEF D., MOTDANIELA, JULEAN C., TETILEANU RAMONA, CORCIONIVOSCHI N. (2009):The effect of medicinal plants and plant extracted oils on broiler duodenum morphology and immunological profile Romanian Biotechnological Letters Volume: 14 Issue: 4 Pages: 4606-4614

ŞTEF LAVINIA, MARCU ADELA, DRINCEANU DAN, LUCA IOAN, ŞTEF DUCU, JULEAN CĂLIN, GHERASIM VOICHITA, PANDUR COSMIN (2008): Effect of phyto-additives on broiler meat quality Savremena poljoprivreda, vol. 57, iss. 1-2, pp. 111-116

STEF LAVINIA, MOŢ DANIELA, DRINCEANU DAN, LUCA IOAN, ŞTEF DUCU, JULEAN CĂLIN (2007): Immunomodulatory effect of a few phyto-additives used in feeding of meat production chickens, Savremena poljoprivreda, vol. 56, iss. 3-4, pp. 264-270,