# FINAL REPORT from investigation on:

# The efficacy of APC and DIGESTAROM feed additives as alternatives for antibiotics in broiler chickens nutrition

Performed for: Unia Sp. z o.o. ul. Potocka 14, 01-652 Warszawa

Investigators: Prof. Dr. hab. Jerzy Koreleski, Dr. Sylwester Świątkiewicz and Dr. Marek Wawrzyński

Conducted by: Research Station "Rossocha Sp. z o.o." 96-204 Kurzeszyn, Poland

Experimental period: November – December 2005

Aleksandrowice, January, 2006

#### **1. Introduction**

Feed antibiotic growth promotors (AGP) were successfully used as additives to diets of housing animals since many years. As a substances produced by some species of bacteria or fungi, antibiotics can inhibit the growth of harmful microorganisms in alimentary tract. The influence of antibiotics on microorganisms and absorption processes in intestines allowed to obtain better performance of animals. As a result of antibiotics use the higher body weight gains, better feed utilization, better sanitary conditions on farms (limitation of diarrhoea and wet litter), better health status and lower mortality of animals were observed. Positive effect of antibiotics was particularly pronounced in case of broilers kept in conditions of high density, where threat from harmful microorganisms is especially high.

Despite of above-mentioned advantages of antibiotics, from January 1, 2006 these feed additives are banned from use in European Union. It is related with growing demands of consumers for safety food and suspicions of positive relation between use of antibiotics and increase of resistance of microorganisms.

In the conditions of intensive animal production this ban may have negative impact on health and production results. The excessive amount of harmful bacteria in intestines, for example *Clostridum sp.*, or *E. coli*, cause a number of alimentary illnesses and increase mortality, especially in young birds. Microbiological unbalance of intestine may cause diarrhea, wet litter problem, foot-pad lesions and worsening of sanitary conditions in buildings.

Many institutions and feed companies have been carrying out from years experiments on natural substances, which could be alternatives for AGP. Probiotics, prebiotics, acidifiers, mannan oligosaccharides, enzymes, herb extrtracts and spices are as additives, which positively affected health and production indices in animals.

APC and DIGESTAROM preparations are feed additives present from years on feed market. DIGESTAROM is preparation of plant origin, containing herbs, spices and essential oils. These substances have negative effect on growth of pathogenic bacteria and may positively influence on immunity of organism and increase feed intake. DIGESTAROM could also stimulate secretion of digestive juices and bile and in this way positively affects nutrients digestibility. Results of previous experiments on calves, fatteners and poultry indicated high efficacy of APC in animal nutrition.

APC preparation is multicomponental, so it could lead to wide spectrum of effects in animal organism. APC contains surface-active substances: -diatomite (sediment greatly enriched in biogenic silica), -vermiculite (magnesium-aluminumiron silicate) and -organic acids (malic, tartaric and acetic). Because of properties of APC ingredients, producer declares its positive influence on utilization of protein and macroelements (calcium and phosphorus) and on non-specific immunological response of organism. In broiler production it could lead to improvement of performance, decrease of mortality and morbidity and to reduction of ammonia in buildings. As producer declares, use of APC enables to reduce the level of protein, calcium and phosphorus in diets – without negative effects on performance.

#### 2. Aim of experiment

Aim of experiment was to study the effect of addition of DIGESTAROM and APC or feed antibiotic to the broiler diet on performance and results of slaughter analysis.

Effect of DIGESTAROM was compared to feed antibiotic (Avilamycin), when diet with standard level of nutrients was used. Similarly, APC was examined as additive to diet, but diet with reduced content of crude protein, calcium and phosphorus. The effect of simultaneous addition of both studied preparations to the diet with reduced level of nutrients was also investigated.

#### **3.** Material and methods

#### 3.1. Animals

Experiment was carried out on 6600 Ross broilers from 1 to 40 days of age, kept in floor pens (220 birds per pen). 1-day old chickens with initial body weight of 35 g were randomly alloted to 6 experimental groups with 5 replicates of 220 birds (each group consists of 1100 chicks). Broilers had free access to experimental diets, according to scheme of experiment (table 1). Briolers were kept in standard zootechnic

conditions with constant access to water. During experiment three types of diet were used: starter (1-21), grower (22-35) and finisher (36-40 days of age) – table 2, 3 and 4.

#### 3.2. Experimental mixtures and scheme of experiment

In the experiment corn-soybean (starter) and corn-wheat-soybean (grower and finisher) mixtures were used. Basal diets were characterized by standard (group I and II) or reduced level of crude protein, calcium and phosphorus (group III, IV, V and VI). Diets contained no antibiotic growth promotors.

Standard level diets were supplemented with AGP Avilamycin (7 g/t, group I) or DIGESTAROM preparation (150 g/t., group II). Mixtures with reduced level of protein, calcium and phosphorus were not supplemented (group III) or supplemented with Avilamycin (7 g/t., group IV), with APC preparation (2000 g/t., group V) or simultaneously with APC and DIGESTAROM (2000 and 150 g/t., respectively, group VI).

#### 3.3. Studied parameters

In the experiment birds were weighted three times: -as 1-day old, -at 21 and -at 40 days of age (after 12-hours starvation). Feed intake and number of death birds were noted in periods and health status of chickens was observed. Based on these data feed conversion (feed per gain), mortality and Production Index (PI) were calculated. Following formula was used for PI calculation:

 $PI (points) = \frac{final body weight (kg) x (100\% - \% of mortality)}{feed conversion ratio (kg/kg) x age (days)} x 100$ 

At the end of experiment, after 12 hours of starvation, 10 chickens (5  $\circ$  and 5  $\circ$ ) from each group were randomly chosen and sacrificed by decapitation. Live weight and weights of carcass, giblets, breast meat and abdominal fat were measured. Dressing percentage, breast meat yield and content of giblets and abdominal fat in carcass were calculated.

#### 3. 4. <u>Statistical analysis</u>

The data were subjected to statistical analysis using one-way factorial analysis of variance. Significance of differences between means was determined by Duncan's multiple range test (Statistica 5.0 PL software). Statistical significance was accepted at  $P \leq 0.05$ .

#### 4. Results and discussion

#### 4.1. Indices of performance

The mean results of experiment were: 665 g body weight at 21 day and 2060 g at 40 day of age, feed intake of 3965 g/chick for total period of experiment, feed conversion (kg feed per 1 kg of body weight) 1.92, mortality 1.83%, production index PI 263 points.

#### 4.2. Carcass indices

Average dressing percentage was 74.0 and the percentage of breast meat 22.9, abdominal fat 2.22 and 5.07 giblets in carcass

#### 4.3. Effect of DIGESTAROM supplementation

Feed additive DIGESTAROM contained the herbs and spice extracts and essential oils was added in amount of 150 g/t to diet for chickens. Control chickens from group I were fed the standard diet supplemented with 7 g of Avilamycine/ton.

Results of performance in group II compared with group I indicate a high efficiency of DIGESTAROM as a feed additive (Table 5). Chickens from group II fed DIGESTAROM achieved significantly higher body weight (P<0.05) than in I group fed Avilamycine. During first period of feeding (1-21 d.) and for total period of experiment (1-40 d. of age) a differences between groups were 4.5 % and 3.0 %, respectively. Addition of DIGESTAROM positively affected feed conversion for total period of feeding – lowering feed expenses for weight unit for about 2.5 % (P<0.05).

In chickens fed supplemented diets a slightly higher feed intake and lower dead percentage was noted, but differences were statistically not confirmed. Production index PI includes together weight gain, feed conversion and survival rate of chickens for total period of experiment. The PI value for group II fed DIGESTAROM was higher by 5.1% as compared to group I fed Avilamycine and the difference was statistically confirmed (Table 5).

In case of slaughter indices the differences between group I and II were not significant. However carcasses of chickens fed DIGESTAROM characterized slightly higher level of breast meat than Avilamycine group (the difference 2.6%).

#### 4.4. Effect of APC supplementation

According to declared property APC was added (2000 g/t.) to feed mixture with reduced level of crude protein, calcium and phosphorus. Results (group III) were compared to chickens fed diets supplemented with APC (group V) or Avilamycine (group IV).

Addition of APC enlarged body weight (P<0.05) when compared to group III and IV (Table 5) and the differences at 21 d. were 2.4 and 4.5 %, respectively. For total period of experiment chickens fed diet supplemented with APC also grew significantly faster. The differences were even bigger than in first period of feeding and attained 4.8 or 4.9 % as compared to broilers fed no additives or Avilamycine. Addition of APC preparation positively affected the feed conversion for total period of experiment. The improvement compare to group fed not supplemented diet was range 1.6 % (P<0.05) and 1.1 % to group with Avilamycine.

The feed intake and survival rate in chickens fed APC supplemented diets were slightly higher than in remaining groups but differences were non significant. The PI value was significantly higher (P<0.05) in chickens fed diet supplemented with APC (Table 5). The differences to broilers fed not supplemented diet or diet with Avilamycyne attained 6.5 and 5.3%, respectively.

APC addition to diet had no effect on slaughter indices in chickens (Table 6). When compared with chickens fed Avilamycine slightly higher slaughter performance (1.3%) and breast meat level in carcasses (6.3%) was found in broilers fed diet with APC.

#### 4.5. Effect of simultaneous application of APC and DIGESTAROM

The diet with reduced content of crude protein, calcium and phosphorus was supplemented with both investigated feed additives. Results obtained in experiment indicate that simultaneous application of APC and DIGESTAROM to this type of diet is not profitable. As compared to group III without supplementation the performance of chickens fed both feed additives was not improved and quite the reverse the feed intake and feed conversion and body weight were found to be lower.

It seems not unlikely that when added to diet of lower crude protein, Ca and P content in case of both preparations an undefined negative interaction may exists. The lower feed intake may suggest the unprofitable organoleptic property of diet. It may be the effect of simultaneous influence of organic acids and essential oils on taste or smell of the diet.

### 5. Conclusions

- DIGESTAROM added to standard diet enlarged broiler performance indices and results were better than in diet supplemented with Avilamycine.
- In the diet with lower crude protein, calcium and phosphorus content addition of APC improved broiler performance and this beneficial effect was much larger than in case of diet supplemented with Avilamycine.
- Simultaneous addition of both feed preparations (APC + DIGESTAROM) to low protein, calcium and phosphorus diet had not profitable effect.

In this experiment the investigated feed additives DIGESTAROM and APC were find a good substitute for antibiotic growth promotors. DIGESTAROM was effective in standard diet and APC in diet with reduced content of protein, Ca and P. In contrary simultaneous application of both additives not gave any profitable effect.

## Table 1.Scheme of experiment

Group	Level of crude	Antibiotic	DIGESTAROM	APC	
	protein. Ca and P	(Avilamycin)			
	in the diet				
I- control	Standard	7 g/t *	-	-	
II- experimental	Standard	-	150 g/t	-	
III- control	Reduced	-	-	-	
IV-experimental	Reduced	7 g/t *	-	-	
V-experimantal	Reduced	-	-	2000g/t	
VI-experimental	Reduced	-	150 g/t	2000g/t	

\*/ as amount of active substance

## Table 2.Composition of starter diets (%)

Item	Standard diet	Diet with reduced level		
		of protein, Ca and P		
Corn	57.78	63.66		
Soybean meal (46% crude protein)	36.00	32.50		
Soybean oil	2.00	1.00		
Fodder limestone	1.10	0.77		
Dicalcium phosphate	1.90	0.78		
NaCl	0.31	0.31		
DL-Met	0.25	0.24		
L-Lys HCl	0.16	0.21		
L-Tre	-	0.03		
Vitamin-mineral premix (without	0.50	0.50		
antibiotic)				
Crude protein (g)	220	209		
Metabolizable energy (MJ/kg)	12.9	12.9		
Lys (g)	12.7	12.4		
Met (g)	5.8	5.65		
Tre	8.35	8.30		
Ca (g)	9.50	5.80		
Total P (g)	7.50	5.40		
Available P (g)	4.40	2.60		
Na (g)	1.50	1.50		
Cl (g)	2.20	2.20		

## Table 3.Composition of grower diets (%)

Item	Standard diet	Diet with reduced level		
		of protein, Ca and P		
Corn	50.28	55.96		
Wheat	10.00	10.00		
Soybean meal (46% crude protein)	31.50	28.00		
Soybean oil	4.00	3.00		
Fodder limestone	1.17	0.77		
Dicalcium phosphate	1.76	0.86		
NaCl	0.31	0.31		
DL-Met	0.23	0.23		
L-Lys HCl	0.20	0.28		
L-Tre	0.05	0.09		
Vitamin-mineral premix (without	0.50	0.50		
antibiotic)				
Crude protein (g)	205	194		
Metabolizable energy (MJ/kg)	13.1	13.1		
Lys (g)	12.0	11.8		
Met (g)	5.40	5.30		
Tre	8.20	8.10		
Ca (g)	9.30	5.80		
Total P (g)	7.15	5.40		
Available P (g)	4.05	2.65		
Na (g)	1.50	1.50		
Cl (g)	2.20	2.20		

## Table 4.Composition of finisher diets (%)

Składnik	Standard diet	Diet with reduced level		
		of protein, Ca and P		
Corn	53.44	59.20		
Wheat	10.00	10.00		
Soybean meal (46% crude protein)	28.50	25.00		
Soybean oil	4.10	3.00		
Fodder limestone	1.20	0.76		
Dicalcium phosphate	1.68	0.89		
NaCl	0.31	0.31		
DL-Met	0.16	0.16		
L-Lys HCl	0.09	0.14		
L-Tre	0.02	0.04		
Vitamin-mineral premix (without	0.50	0.50		
antibiotic)				
Crude protein (g)	195	183		
Metabolizable energy (MJ/kg)	13.2	13.2		
Lys (g)	10.4	10.0		
Met (g)	4.60	4.50		
Tre	7.40	7.20		
Ca (g)	9.15	5.80		
Total P (g)	6.90	5.40		
Available P (g)	3.90	2.65		
Na (g)	1.50	1.50		
Cl (g)	2.20	2.20		

Group	Kind	Feed additive	Body	Body	Feed	Feed	Morta-	PI*
	of diet		weight at	weight at	con-	intake	lity	
			21 days	40 days	version	(1-40)		
			of age	of age	(1-40)			
			g	g	kg	g	%	points
Ι	Standard	Avilamycin	642 a	2007 a	1.94 bc	3896 a	1.74	254 ab
Π		DIGESTAROM	671 b	2068 b	1.91 de	3954 a	1.28	267 c
III	Reduced	-	678 bc	2062 b	1.92 cd	3964 b	2.10	263 bc
	level of							
IV	protein.	Avilamycin	664 b	2077 b	1.91 de	3966 b	2.28	266 c
	Ca and P							
V		APC	694 c	2160 c	1.89 e	4091 b	1.82	280 d
		APC +						
VI		DIGESTAROM	640 a	1990 a	1.97 a	3919 a	1.74	248 a
SEM			4.48	12.1	0.0056	14.6	0.136	2.22

### Table 5.Performance of broiler chickens

\*/ Production Index

a. b. c. d. e – values in columns with different letters differ significantly (P<0.05)

Group	Kind	Feed additive	Carcass	Breast meat	Content of	Content of
	of diet		yield	yield	abdominal fat	giblets
					in carcass	in carcass
			%	% carcass	% carcass	% carcass
_	~					
I	Standard	Avilamycin	73.4	22.8	2.30	4.85
Π		DIGESTAROM	73.5	23.4	2.06	5.24
III	Reduced	-	74.6	23.1	2.36	4.90
	level of					
IV	protein. Ca	Avilamycin	73.0	22.3	2.03	5.30
	and P					
V		APC	74.7	23.7	2.42	4.87
		APC +				
VI		DIGESTAROM	74.7	22.3	2.14	5.24
SEM			0.256	0.193	0.074	0.072

## Table 6.Results of slaughter analysis

 Table 7.
 Comparison of feed costs and incomes from sale of broilers in experiment

	Weight of	Incomes from	Amount	Cost	Cost of	Total:	Difference:
	slaughter	sale of slaughter	of used	of	additive	feed +	Income from
	birds	birds	feed	used	(Avilamycin	addi-	sales
		(kg x		feed	or DIGEST-	tive	– cost of feed
		2.52 PLN)			AROM)		and additives
	kg	PLN	kg	PLN	PLN	PLN	PLN
Avilamycyna	2168	5463	4214*	3171	18	3189	2274
DIGESTAROM	2244	5655	4304**	3221	38	3259	2396
Advantage of DIGESTAROM	76	192	90	50	20	70	122

A/Effect of DIGESTAROM (standard diet) – data calculated for groups (1100 birds)

\*/ 500 kg of starter diet, 2000 kg - grower and 1714 kg - finisher

\*\*/ 500 kg of starter diet. 2000 kg – grower i 1804 - finisher

B/ Effect of APC (diet with reduced level of protein, calcium and phosphorus) – data calculated for groups (1100 birds)

	Weight	Incomes from	Amount	Cost of	Cost of	Total:	Difference:
	of	sale of	of used	used	additive	feed +	Income from
	slaughter	slaughter birds	feed	feed	(Avilamycin	addi-	sales
	birds	(kg x			or DIGEST-	tive	– cost of feed
		2.52 PLN)			AROM)		and additives
	kg	PLN	kg	PLN	PLN	PLN	PLN
Bez dodatków	2225	5607	4283*	3027	-	3027	2580
Avilamycyna	2235	5632	4278**	3024	18	3042	2590
APC	2320	5846	4402***	3108	107	3215	2631
APC							
+ DIGESTAROM	2134	5378	4217****	2982	141	3123	2255
Advantage of APC							
(as compared							
to Avilamycin)	85	214	90	50	20	173	41

\*/ 500 kg starter diet, 2000 kg – grower i 1783 kg – finisher \*\*/ 500 kg starter diet. 2000 kg – grower i 1778 kg - finisher \*\*\*/ 500 kg starter diet, 2000 kg – grower i 1902 kg - finisher \*\*\*\*/ 500 kg starter diet, 2000 kg – grower i 1717 kg – finisher

For calculation following data were taken: Euro rate (January 3, 2006, NBP) – 3.8618 PLN Price of 1 kg slaughter broilers – 2.52 zł.

DIGESTAROM price – 15.3 Euro/kg = 58.4 PLN/kg APC starter price – 7.5 Euro/kg = 28.9 PLN/kg i APC grower, finiszer price - 5.2 Euro = 20.1 PLN/kg Avilamycin (10%) price – 60 PLN/kg Prices of standard diets (as declared realizer of experiment): starter -800 PLN<sup>1</sup>/t, grower -760 - PLN/t, finiszer -730 PLN/t (table 7A).

Prices of diets with reduced level of protein, Ca and P were calculated taking into account decrease (soybean meal, soybean oil, limestone, fodder phosphate) or increase (cereals, crystalline amino acids) of a amounts particular components in comparison with standard diet.

For calculation following data were taken: corn and wheat -0.4 PLN/kg, soybean meal -1.0 PLN/kg, soybean oil -2.5 PLN/kg, fodder phosphate -2.0 PLN/kg, limestone -1.0 PLN/kg, DL-Met -14.9 PLN/kg, Lys HCl -8.1 PLN/kg, L-Tre -21.5 PLN/kg,

Based on this costs of diets with reduced level of protein. Ca and P were: Starter – 750 PLN/t. grower – 720 PLN/t and finisher – 680 PLN./t (table 7B)