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ANIMAL SCIENCE

Use of homeopathic products in pigs feed improves the percentage, quality and marbling of meat

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Abstract: Studies and innovations on alternative feed additives, especially on homeopathic remedies have been highlighted in order to replace or reduce the use of antibiotics in pig production. This paper aimed to assess the addition of homeopathic products in pig diet and their effects on the growth performance, serum metabolites, nutrient and energy digestibility, carcass traits and meat quality. A total of 60 immunocastrated male pigs, weighing on average 30.91 ± 0.95 kg, were distributed in two treatments, 10 replicates and three animals/experimental unit. There was no effect ($P \geq 0.05$) of treatment on the growth performance and serum metabolites. The percentage of acid-insoluble ash recovered in the diet was greater ($P \leq 0.01$) in diets containing homeopathic products. The apparent digestible energy of diets containing homeopathic products was reduced ($P \leq 0.01$) in the growing phase and reduced ($P \leq 0.01$) the apparent digestibility coefficients of dry matter, crude protein, soluble neutral and acid detergent fibers, and gross energy in the growing and finishing phases. Pig that received diets with homeopathic products had higher ($P \leq 0.05$) amount of meat, percentage of meat and marbling. The use of homeopathic products in diets improves the percentage and quality of meat, as well as the marbling of the pig carcass, maintaining the performance.

Key words: carcass traits, digestibility, growth performance, homeopathy, serum metabolites, swine.

INTRODUCTION

The current pig production systems present higher animal density per area, concomitantly, a greater health challenge, which results in greater diseases occurrence in the herd and animals more susceptible to infectious and respiratory diseases, such as atrophic rhinitis and pneumonia; as well as opportunistic diseases (D'Alencar et al. 2011, Morés et al. 2015).

According to Moura et al. (2014), liver problems also must be checked thoroughly because they cause considerable economic losses for both the producer and the slaughter plant, for perihepatitis, abscesses and changes in liver consistency and color; reduction of body weight gain, nutrient utilization efficiency of diets, worse feed conversion ratio, increased in mortality and expenses on medicament and vaccines (Barcellos et al. 2008).

In view of this, the use of antibiotics as growth promoters has become a frequent practice. However, such use has been questioned due to possible residues in animal products, especially in pork, and the possibility of cross-resistance with microorganisms in the human body (Lora Graña et al. 2010, Kil et al. 2011).

Thus, the use of nutritional strategies and alternative products, as well as probiotics, organic acids, plant extracts and enzymes is increasing (Camerlink et al. 2010, Geron et al. 2013), similarly, the homeopathic products has been an excellent option to act in the pathogens control and in the prevention/treatment of diseases, without leaving residues in the final product (Soto et al. 2008, Kil et al. 2011). In pig production, homeopathy has been used to prevent diseases, as well as metabolic disorders and enteric problems, besides improvements in the immunity and reactional capacity of animals to infections and parasites (Soto et al. 2008), obtaining positive results also in suckling piglets (Felipelli & Valente 2009).

Studies conducted with the purpose of evaluating the use of homeopathic products in pig feed are scarce, and further research is needed. However, information on homeopathy can be found (Kiefer et al. 2012, Doehring & Sundrum 2016, Epstein & Bell 2016). Custódio et al. (2017) evaluated the effect of addition of the Figotonus® product at the levels of 0 g, 1 g, 5 g and 10 g/animal/day for dairy sheep in order to measure the health indicators of the animals, focusing on the reduction of ketosis cases and observed that all animals receiving the HP reduced the serum concentration of the AST, GGT and β-ketone enzymes, indicating their ability to prevent clinical and subclinical ketosis and their action as a liver protector.

The active principles of some plants have been evaluated by homeopathy, especially the active principles of plants and animal secretions such as *Baptisia tinctoria* and *Lachesis muta* for preventive treatments of pulmonary and intestinal infections, in addition to the biotherapeutics *Streptococcinum*, *Yersinia* and *Colibacilinum* in order to improve the immune and hepatic systems of animals (Real 2012a).

In this sense, the goal of this study was to assess the addition of homeopathic products in pig diet during the growing (GROW) and finishing (FINISH) phases and their effects on the growth performance, serum metabolites, nutrient and energy digestibility, carcass traits and quality of meat.

MATERIAL AND METHODS

The project was undertaken in the Swine Sector of the Universidade Estadual do Oeste do Paraná-UNIOESTE. The experiment was approved by the Ethics Committee on Animal Use on July 14, 2017.

The animals were housed in masonry shed, with curtains, ceramic roof tiles and concrete floor. Each pen was 5.8 m^2, arranged in two rows, equipped with semi-automatic feeders and nipple-type drinking fountains.

A total of 60 entire male pigs (Landrace x Large White), immunocastrated at 90 and 120 days old, with initial body weight of 30.91 ± 0.95 kg, were distributed in a completely randomized design, allocated in two treatments, 10 replicates and three animals per experimental unit.

The treatments were composed of a control diet (DC) and DC with the addition of 3.0 kg/ton of HP Sanoplus® (indicated for the prevention of respiratory and intestinal diseases) and 3.0 kg/ton of HP Figotonus® (for disease prevention hepatic), which was composed by the combination of minerals and medicinal plants: Phosphorus 10^{-28}, *Carboneum tetrachloricum* 10^{-30}, *Chelidonium majus* 10^{-24}, *Cardus marianus* 10^{-24}, *Natrum muriaticum* 10^{-400}, *China officinalis* 10^{-24}, *Myrica cerifera* 10^{-60} and *Chionantus virginica* 10^{-30} (Real 2012b). The HP indicated for the preventive treatment of respiratory and intestinal diseases was composed by *Lachesis muta* 10^{-400}, *Baptisia tinctoria* 10^{-60}, *Sulphur iodatum* 10^{-30} and by the biotherapeutics *Streptococcinum* 10^{30}, *Yersinia* 10^{-60} and *Colibacilinum* 10^{-30} (Real 2012a).

The experimental diets were isonutritional and formulated according to the productive phases: GROW I (30 to 50 kg), GROW II (50 to 70 kg), FINISH I (70 to 100 kg) and FINISH II (100 to 136 kg), following the nutritional recommendations of Rostagno et al. (2011), Table I.

At the beginning and at the end of each experimental phase, the animals, feed and leftovers were weighed for analysis of the growth performance (average daily body weight gain, average daily feed intake and feed conversion ratio) during GROW, FINISH and total period of the experiment, which lasted 99 days.

Table I. **Centesimal and calculated composition of experimental diets.**

Ingredients (%)	GROW I		GROW II		FINISH I		FINISH II	
	C[1]	HP[2]	C[1]	HP[2]	C[1]	HP[2]	C[1]	HP[2]
Ground corn (7.88%)	66.25	66.25	69.53	69.54	74.88	74.89	81.61	81.61
Soybean meal (45.22%)	28.79	28.79	26.33	26.33	21.23	21.23	15.82	15.82
Dicalcium phosphate	1.44	1.44	1.207	1.207	1.170	1.170	0.799	0.799
Homeopathic products	-	0.600	-	0.600	-	0.600	-	0.500
Limestone calcitic	0.815	0.214	0.727	0.125	0.703	0.101	0.583	0.073
Soybean oil	0.804	0.803	0.520	0.520	0.251	0.250	0.000	0.000
Lysine sulfate (55%)	0.632	0.632	0.537	0.537	0.697	0.697	0.367	0.367
DL-methionine (99.5%)	0.182	0.193	0.136	0.136	0.139	0.139	0.029	0.029
L-threonine (96.8%)	0.167	0.167	0.124	0.124	0.154	0.154	0.041	0.041
L-tryptophan (99%)	0.016	0.016	0.091	0.091	0.021	0.021	0.005	0.005
Premix min. - vit.[3,4]	0.500	0.500	0.500	0.500	0.500	0.500	0.400	0.400
Common salt	0.390	0.390	0.364	0.364	0.337	0.337	0.329	0.329
Tiamulin	0.010	0.010	0.011	0.011	0.010	0.010	0.011	0.011
Calculated composition								
Crude protein (%)	19.00	19.00	18.00	18.00	16.20	16.20	13.93	13.93
Metaboliz. energy (kcal/kg)	3230	3230	3230	3230	3230	3230	3230	3230
Total calcium (%)	0.747	0.747	0.653	0.653	0.624	0.624	0.474	0.474
Available phosphorus (%)	0.369	0.369	0.323	0.323	0.308	0.308	0.231	0.231
Sodium (%)	0.180	0.180	0.170	0.170	0.160	0.160	0.150	0.150
Digestible lysine (%)	1.196	1.196	1.087	1.087	1.000	1.000	0.748	0.748
Digestible met + cyst (%)	0.706	0.706	0.641	0.641	0.600	0.600	0.449	0.449
Digestible threonine (%)	0.777	0.777	0.707	0.707	0.670	0.670	0.501	0.501
Digestible tryptophan (%)	0.215	0.215	0.196	0.196	0.180	0.180	0.135	0.135

[1]Diet control; [2]Diet with homeopathic products; [3]Premix mineral-vitamin of growing (per kg of the product): calcium (min) 6000 (max) 10000 mg; biotin (min) 0.08 mg; humidity (max) 130 g; mineral matter (max) 55 g; lysine (min) 7.20 g; methionine (min) 2.07 g; tryptophan (min) 0.45 g; iron (min) 75 mg; sodium (min) 2 g; phosphorus (min) 3000 mg; copper (min) 62.5 mg; choline (min) 120.60 mg; manganese (min) 37.20 mg; niacin (min) 20.85 mg; selenium (min) 0.27 mg; vitamin A (min) 7,080.00 IU; vitamin B_1 (min) 0.95 mg; vitamin B_2 (min) 4.25 mg; vitamin B_6 (min) 1.80 mg; vitamin B_{12} (min) 20.80 mcg; vitamin D_3 (min) 1,400.00 IU; vitamin E (min) 50.25 IU; vitamin K_3 (min) 2.30 mg; iodine (min) 1.50 mg; threonine (min) 2.05 g; zinc (min) 90.00 mg; pantothenic acid (min) 9.50; mg; halquinol (min) 120.00 mg; crude protein (min) 165 mg; ethereal extract (min) 30 g; folic acid (min) 0.30 mg; crude fiber (max) 35 g; antioxidant additive (min) 6.30 mg; bentonite (min) 1.0 g. [4]Premix mineral-vitamin of finishing (per kg of the product): calcium (min) 6 (max) 7.5 g; biotin (min) 0.09 mg; humidity (max) 130 g; mineral matter (max) 55 g; iron (min) 75 mg; sodium (min) 2.0 g; lysine (min) 7.70 g; methionine (min) 2.05 g; phosphorus (min) g; copper (min) 3,000.00 mg; choline (min) 120.50 mg; manganese (min) 37.20 mg; niacin (min) 22 mg; halquinol (min) 120.00 mg; selenium (min) 0.27 mg; vitamin A (min) 7,080.00; vitamin B_1 (min) 0.95 mg; vitamin B_2 (min) 4.25 mg; vitamin B_6 (min) 1.80 mg; vitamin B_{12} (min) 20.80 mcg; vitamin D_3 (min) 1,400.00 IU; vitamin E (min) 50.25 IU; vitamin K_3 (min) 2.30 mg; iodine (min) 1.50 mg; additive.

Daily maximum and minimum temperatures and the relative humidity - RH (8h00, 12h00 and 17h00) were recorded by means of a digital thermal thermo - hygrometer 1566-1 (J Prolab Ind. e com., Paraná, BR) in the center of the shed at the height corresponding to the animals, obtaining the maximum averages of 28.03 ± 3.79°C, the minimum: 25.82 ± 3.76°C and the RH of 70.40 ± 14.49% in the GROW phase and in the FINISH: 24.05 ± 3.42°C (maximum), 22.75 ± 3.26°C (minimum) and RH: 73.02 ± 11.88%.

Serum metabolites were determined at the beginning and end of each phase. Blood samples were collected via the jugular vein and centrifuged according to Moreno et al. (1997). The collected serum was used for the analysis of aspartate aminotransferase (AST), alanine aminotransferase (ALT) and blood urea nitrogen (BUN) levels, which were performed using the automated biochemical analyzer (flexor model EL 200; Clinical Systems Inc., New York, USA), using commercial Elitech® kits.

At the end of the GROW and FINISH phases, fecal samples were collected for partial digestibility analysis. In the diets of these phases, 1% of acid insoluble ash - AIA (celite™) was added as indicator (Sakomura & Rostagno 2016). At each phase, the animals were adapted three days to the diets and one day for the partial collection of feces, according to methodology adapted from Kavanagh et al. (2001). Subsequently, a 50% aliquot of the stored feces was removed to be processed as determined by Silva & Queiroz (2002).

The dry matter (DM), organic matter (OM), crude protein (CP), ethereal extract (EE), neutral detergent fiber (NDF) and acid (ADF) were analyzed in feces and feeds following the methodology proposed by Silva & Queiroz (2002), and the AIA determination was adapted from the Van Keulen & Young (1977) methodology. It was also determined the gross energy (GE) of diets and feces in isoperibolic calorimetric pump model 6200 (Parr Instrument Company, Moline, IL, USA).

Based on the results, the apparent digestible energy (ADE), AIA recovery percentage and apparent digestibility coefficients (ADC) of: DM, OM, CP, EE, NDF, ADF and GE were calculated according to equation proposed by Matterson et al. (1965).

At the end of the experimental period, all animals were weighed and subjected to 8-h fasted, transported to a commercial slaughterhouse and slaughtered. The slaughter was carried out according to the desensitization protocol for the animal's humanitarian slaughter (Brasil 2000).

The quantitative traits of the carcass: carcass weight (CW), meat percentage (MP), meat amount (MA), carcass yield (CY), muscle depth (MD), backfat thickness (BT) and carcass length (CL) were determined by the Hennessy GP4/BP4 (Hennessy Garding Systems, Auckland, NZ) pig carcass typing pistol.

Meat quality analyzes: pH, temperature, marbling (MAR), liquid loss by dripping (LLD), liquid loss by thawing (LLT), liquid loss by cooking (LLC), shear force (SF) and evaluation of meat color were made according to methodology of Bridi & Silva (2009).

The pH and temperature in the *Longissimus dorsi* muscle were measured with the aid of a portable pH/temperature meter model HI 99163 (Hanna Instruments Inc., Rhodes Island, USA). The SF evaluation was performed using the CT3 Texture Analyzer (Brookfield Engineering Labs., Inc., Middleboro, MA, USA). The coloring of the meat was determined using a Konica Minolta's portable CR-400 colorimeter (Konica Minolta Holdings Inc., Tokyo, Japan). The determination of loin eye area (LEA) was performed according to a methodology described by Bridi & Silva (2009).

Statistical analyzes were carried out with the aid of Statistical Analysis Systems (SAS Inst. Inc., Cary, NC, USA, 2015) and the data were submitted to analysis of variance. The 5% probability level was considered. The statistical model used was: $Y_{ij} = \mu + \alpha_i + \varepsilon_{ij}$; in which, Y_{ij} = j-th observation of factor level i; μ = overall mean of the data; α_i = effect of level i of the factor and ε_{ij} = random component of the error.

RESULTS

There was no effect (P≥0.05) of treatment on the growth performance in the GROW, FINISH and total period (Table II).

No differences were found between the treatments (P≥0.05) for the BUN nor for the AST and ALT enzymes in any of the phases (Table III).

For the digestibility results, there were differences (P≤0.01) between the treatments for the percentage of AIA recovered in the feed (AIA-feed) of both phases, besides the ADE in the GROW phase (Table IV). Apparent digestibility coefficients for DM, CP, OM, NDF, ADF and GE in the two analyzed phases were reduced (P≤0.01) in the animals with HP addition to the diet. However, the ADC of EE in the GROW phase, and the ADC of the OM, the percentage of AIA-feces, the GE and the ADE in the FINISH phase were not influenced (P≥0.05).

There were no differences (P≥0.05) on the CW, CY, MP, BT, initial and final carcass pH, as well as the initial and final temperature, LLD, LLT and LLC, SF, LEA and all parameters of coloration as a function of treatments (Table V). However, MA (P = 0.05), MP (P = 0.04) and MAR (P = 0.04) were higher in animals receiving HP in the diet.

DISCUSSION

The HP were effective in the production of pigs, improving carcass traits despite the reduction of the nutrient digestibility coefficients and, although the performance was equal among the treatments, the feed efficiency was better, generating greater production savings. However,

Table II. Growth performance of pigs during the growing, finishing and total period phases depending on the treatments.

Variables	Treatments		CV (%)[1]	P-value[2]
	Control	Homeopathy		
Growing phase (30 to 70 kg)				
Initial body weight (kg)	30.93	30.88	-	-
Final body weight (kg)	67.50	69.42	3.60	0.10
Average daily feed intake (kg/day)	1.71	1.75	3.93	0.15
Average daily body weight gain (kg/day)	0.88	0.93	6.14	0.07
Feed conversion ratio (kg/kg)	1.94	1.90	6.06	0.32
Finishing phase (70 to 136 kg)				
Final body weight (kg)	133.93	136.92	3.30	0.15
Average daily feed intake (kg/day)	2.90	2.86	7.08	0.70
Average daily body weight gain (kg/day)	1.21	1.19	8.75	0.65
Feed conversion ratio (kg/kg)	2.40	2.33	7.63	0.38
Total period (30 to 136 kg)				
Average daily feed intake (kg/day)	2.37	2.37	4.92	0.99
Average daily body weight gain (kg/day)	1.06	1.09	3.87	0.14
Feed conversion ratio (kg/kg)	2.24	2.17	4.73	0.20

[1]CV (%) = coefficient of variation; [2]P-value = Probability.

it is possible that the absence of health challenge has reduced the effect of HP on the growth performance of the pigs.

One of the HP consists of the combination of several herbs and they are composed of essential oils containing triterpenes, such as myricadiol, as well as different flavonoids and phenols, in addition to myricitrin which exhibits antibiotic activity against an extensive range of bacteria. These essential oils may have antibacterial action, through pathogen control and of your antioxidant activity, influence digestibility and nutrient uptake and stimulate enzyme activity (Chilante et al. 2012, Vijnovsky 2012, Koiyama et al. 2014), balancing the microbiota population and improving performance.

As the growing rate was similar between treatments, it was expected that the BUN did not differ between treatments in any of the phases, since the feed intake and, consequently, protein was similar. The observed values are within the standards for porcine species ranging from 9.97 to 29.92 mg/dL (Meyer & Harvey 2004).

The concentrations of the AST and ALT enzymes observed in this study demonstrated that the use of HP in the diet of pigs did not cause hepatic damage to the animals, highlighting that the product could be used without affecting the health of the pigs, since the constituents herbs of HP Figotonus® have been tested in phytotherapy as a tonic and regenerative function of liver cells, biliary stimulants and used in the treatment of liver diseases (Vijnovsky 2012) without negative effects. Thus, the values of these enzymes are within the standard values for pigs, which are 31 to 58 U/L and 32 to 84 U/L for ALT and AST, respectively (Meyer & Harvey 2004).

The fact that the HP used have a high concentration of calcium carbonate ($CaCO_3$) as a vehicle may have reduced the ADC of the nutrients due to the lower digestibility of $CaCO_3$, already the highest content of mineral matter affected the digestibility and, as a consequence, the ADC and ADE. Corroborating with this experiment, reductions in nutrient DC were also found by Jiang et al. (2013) when analyzing the effect of $CaCO_3$ and calcium citrate in the piglet diet.

Although the addition of HP had reduced nutrient ADC in the phases and ADE in the GROW phase, it was found that the performance of the animals was maintained, demonstrating the better efficiency in nutrient utilization and greater availability of energy for the animals fed HP. Similar results were reported by Jiang et al. (2013) when evaluating Ca sources for piglets.

Table III. Serum metabolites of pigs during the evaluated phases depending on the treatments.

Variables	Treatments		CV (%)[1]	P-value[2]
	Control	Homeopathy		
Growing phase (30 to 70 kg)				
Aspartate aminotransferase (U/L)	36.12	31.08	48.92	0.35
Alanine aminotransferase (U/L)	27.17	29.04	18.98	0.28
Blood urea nitrogen (mg/dL)	18.76	20.06	28.40	0.47
Finishing phase (70 to 136 kg)				
Aspartate aminotransferase (U/L)	36.94	29.29	45.76	0.08
Alanine aminotransferase (U/L)	39.04	40.21	33.32	0.78
Blood urea nitrogen (mg/dL)	19.80	20.78	32.05	0.64

[1]CV (%) = coefficient of variation; [2]P-value = Probability.

In relation to AIA, the higher intake of inorganic material by the animals that consumed HP increased the $CaCO_3$ intake, increasing the AIA-feces; overestimating the values recovered. According to Sales & Janssens (2003), the concentration of recovered AIA depends on the ingredients used in the diets and their composition.

The values of GE did not differ between the treatments in any of the phases, as well as ADE in the final phase of this experiment, due to the fact that the diets were isoenergetic. Thus, the addition of HP did not influence the feeds energy, improving the deposition of muscle tissue because the available nutrients were metabolized and deposited in the carcass in the shape of meat in the HP treated animals.

Table IV. Apparent digestibility coefficients of nutrients, gross and digestible energy content and recovery of acid insoluble ash (AIA) depending on the treatments.

Variables	Treatments		CV (%)[1]	P-value[2]
	Control	Homeopathy		
Growing phase (30 to 69 kg)				
Dry matter (%)	85.10	79.32	2.84	<0.01
Crude protein (%)	82.73	75.54	4.08	<0.01
Organic matter (%)	88.07	83.39	3.71	<0.01
Ethereal extract (%)	39.97	28.89	36.87	0.07
Neutral detergent fiber (%)	93.40	90.68	2.08	0.01
Acid detergent fiber (%)	87.52	81.84	4.92	0.01
Gross energy (%)	84.88	79.13	3.08	<0.01
AIA-diet (%)	1.08	1.58	0.00	<0.01
AIA-feces (%)	7.14	7.76	17.56	0.30
Gross energy (kcal/kg)	4469.02	4447.50	2.00	0.60
Apparent digestible energy (kcal/kg)	3551.16	3341.01	4.98	<0.01
Finishing phase (70 to 135 kg)				
Dry matter (%)	86.42	84.05	0.74	<0.01
Crude protein (%)	82.70	77.73	2.05	<0.01
Organic matter (%)	89.40	87.31	1.35	0.06
Ethereal extract (%)	65.60	67.52	7.97	0.46
Neutral detergent fiber (%)	89.74	87.89	1.15	0.01
Acid detergent fiber (%)	79.74	74.59	3.10	0.01
Gross energy (%)	86.19	84.02	0.95	<0.01
AIA-diet (%)	1.23	1.40	0.00	<0.01
AIA-feces (%)	8.10	8.35	26.14	0.81
Gross energy (kcal/kg)	4239.85	4275.75	2.18	0.43
Apparent digestible energy (kcal/kg)	3416.00	3406.70	0.90	0.99

[1]CV (%) = coefficient of variation; [2]P-value = Probability.

The use of HP increased the available energy, reflecting in higher MA and MP, related to muscle tissue synthesis, which demands lower energy expenditure when compared to the deposition of adipose tissue (Pinheiro et al. 2013, Leal et al. 2015), improving also the MAR in the animals that consumed HP, a positive fact because according to Bridi & Silva (2013), meats with higher MAR present better tenderness and juiciness, becoming more attractive to consumers.

According to Campos et al. (2013), MAR is influenced by genetic factors, farm conditions and, mainly, of consumed feed and use of additives. In addition, the lack of effect of the HP used on pH, temperature, LLD, LLT, LLC, meat color and SF shows that the quality of the meat has been maintained and, therefore, the products tested can be used.

The data suggest that the HP used in feeds were satisfactory for the meat traits and promising in the production phases because

Table V. **Quantitative and qualitative parameters of carcass and pork depending on the treatments.**

Variables	Treatments		CV (%)[1]	P-value[2]
	Control	Homeopathy		
Quantitative parameters				
Hot carcass weight (kg)	95.85	96.73	5.09	0.63
Carcass yield (kg)	71.07	70.88	4.82	0.88
Muscle depth (mm)	60.33	61.60	7.69	0.46
Meat amount (kg)	57.49	60.19	6.30	0.05
Meat percentage (%)	60.03	62.22	4.61	0.04
Backfat thickness (mm)	16.48	16.05	26.18	0.78
Loin eye area (cm^2)	40.12	44.85	22.60	0.19
Qualitative parameters				
Post-mortem pH	5.87	5.91	3.89	0.68
Muscle pH 24 h after post-mortem	5.53	5.65	3.99	0.16
Post-mortem temperature (ºC)	8.89	8.62	9.58	0.38
Temperature 24 h after post-mortem (ºC)	12.34	11.68	19.59	0.44
Marbling	2.74	3.67	36.53	0.04
Liquid loss by dripping (%)	5.21	5.23	41.01	0.98
Liquid loss by thawing (%)	4.94	5.10	50.62	0.86
Liquid loss by cooking (%)	36.69	36.55	19.44	0.96
Shear force (kgf)	3.83	3.50	25.30	0.33
Luminosity - L	53.94	53.94	7.13	1.00
Saturation - a	5.19	6.14	22.44	0.29
Tone - b	5.67	6.16	26.30	0.97
Chroma	8.05	8.42	22.65	0.60

1CV (%) = coefficient of variation; [2]P-value = Probability.

even with the fact that the ADC being reduced, the performance of the pigs remained. However, it is essential to investigate the mechanism of action of HP on the immune system and on the bacterial population in the pig organism, and from this point to define the best level of addition of these products in the diets of the pigs at all production phases.

In the context, it is concluded that the use of homeopathic products in feeds in the growing and finishing phases improves the percentage and quality of the meat, as well as the marbling of the pig carcass, without affecting the growth performance of the animals.

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