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Suplementación alimenticia con orégano (Origanum vulgare) y complejo enzimático en pollos de carne: I. Indicadores Productivos

Feed Supplement with oregano (Origanum vulgare) and enzymatic complex in chicken meat : I. Performance indicators

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RESUMEN

El empleo de antibióticos promotores de crecimiento (APC) ya es insostenible en la producción avícola y se está realizando investigación en diferentes partes del mundo para poder reemplazarlos con principios que no generen resistencia y que aporten acciones beneficiosas sobre el rendimiento. El orégano se ajusta a estas especificaciones; así mismo, otra estrategia la constituye la suplementación de enzimas digestivas que permitan aprovechar mejor el alimento, ya que el dejar de emplear APC genera mermas en este aspecto, entre otras. Se ensayó el suministro, a través de la dieta, de orégano y enzimas de acuerdo a los siguientes tratamientos: $\mathbf{T_1}$, testigo positivo (dieta con APC); $\mathbf{T_2}$, testigo negativo (sin APC); $\mathbf{T_3}$, dieta con 0.005% de enzimas; $\mathbf{T_4}$, con 0.05% de orégano; $\mathbf{T_5}$, con 0.005% de enzimas y 0.05% de orégano; $\mathbf{T_6}$, con 0.1% de orégano; $\mathbf{T_7}$, con 0.005% de enzimas y 0.1% de orégano. Se empleó 280 pollos Cobb 500 de un día de edad y de ambos sexos, de la empresa Inveragro San Martín de Porras SAC, distrito de Jazán, Amazonas. Dentro de cada tratamiento hubo cuatro réplicas de 10 pollos cada una, dos réplicas de machos y dos de hembras. En la evaluación del rendimiento zootécnico, medido a través del consumo de alimento, incremento de peso, conversión alimenticia, rendimiento de carcasa y características gustativas de la carne, los resultados indicaron que se puede reemplazar al APC con los productos ensayados.

Palabras clave: orégano; enzimas; alimentación; pollos de carne.

ABSTRACT

The use of antibiotic growth promoters (AGP) is already unsustainable in poultry production and research is being carried out in different parts of the world to replace them with principles that do not generate resistance and provide beneficial actions on performance. Oregano adapts to these specifications; another strategy is the supplementation of digestive enzymes that allow using of food, since the stop using AGP generates decrease in this aspect, among others. The supply, through diet, oregano and enzymes was tested according to the following processes:

P1, Positive test (diet with AGP); P2, Negative test (without AGP); P3, diet with 0.005% enzymes; P4, 0.05% oregano; P5, 0.005% of enzymes and 0.05% of oregano; P6, 0.1% oregano; P7, 0.005% enzymes and 0.1% oregano. Amount to 280 one-day-old female and male Cobb 500 chickens were used, from Inveragro San Martín de Porras SAC Company, Jazan district, Amazonas. Within each process were four replicates of 10 chickens each of them, two replicas of males and two of females. In the evaluation of zootechnical yield, measured through feed consumption, weight increment, feed conversion, bones yield and taste characteristics of the meat, the results indicated that AGP can be replaced with the tested products.

Key words: Oregano; enzymes; feeding; meat chickens.

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INTRODUCTION

The permanent challenge of the poultry industry is to improve production rates, thereby ensuring efficiency and profitability. Competitive animal exploitation is characterized by a high productive intensity that triggers stressful situations during the production process, these can potentiate higher incidence of diseases and decrease in production (Ayala et al, 2006).

To mitigate or prevent this situation, within the measures taken, is the use of antimicrobial additives, which have been used since the 1950s, as growth promoters, and they have become an important tool in promoting production suitable for animals raised. In increasingly intensive conditions; the improvement in the animals yield is attributed to the action of these additives on the intestinal microflora (Parrado et al, 2006).

The use of antibiotic growth promoters (AGP) became a controversial issue throughout the world, due to the incidence in the gene portion of microbial resistances that could be transmitted to man and these could have a negative effect on public health. Thus,WHO suggested the prohibition and withdrawal from the world market of AGP in animal feed (WHO, 2008)

There is a growing interest in researching natural alternatives that replace AGP, such as enzymes, prebiotics, probiotics, vegetable extracts (rosemary, oregano, thyme, etc.), phytogenic additives, acidifiers, etc., which may limit to pathogenic bacteria, trap free radicals, improve the absorption capacity of the intestine and productive yield (Carro and Ranill, 2002).

One of the phytogenic alternatives is the use of oregano; which stands out digestive, bacteriostatic and antioxidative actions which have been evidenced in different research projects (Ayala et al., 2006).

Oregano is an aromatic plant native of the Mediterranean.Traditionally, it is cultivated in the southern zone of Peru. It adapts to the inter-Andean valleys above 2600 m.a.s.l, below that altitude, the concentration of essential oils (thymol and carvacrol) decreases (Téllez et al., 2014). It is also used as a mean to obtain a rise in efficiency and palatability in systems where subproducts and foods with low nutritional value are used, which generally tends to affect animal behavior. (Mellor, 2000).Being attributed the antimicrobial activity of oregano, mainly, to the carvacrol and thymol components.
In Peru, essential oils have been extracted from leaves and dried flowers, obtaining 9% carvacrol, 12.2% terpineol and 6.7% p-cymene; however, its composition is variable and, it sometimes includes thymol. (Shiva et al., 2012).

The use of supplemental digestive enzymes to enhance animal production has also been investigated, since they are not absorbed and they do not leave residues in animal products, (Carro et al., 2002), according to Sugiharto (2016), the use of enzymes is important in the poultry feeding , since their diets are composed mainly of corn and soybean that contain for example non-starch polysaccharides (NSP). However, according to Khattak et al., (2006), they prevent the normal digestion and processes of nutrient absorption in the digestive tract. Likewise, Chesson (2001) and Choct (2006) affirm that enzymes reverse the increment in digestive viscosity caused by NSPs.

The following problem was considered in this investigation: How would the use of oregano and enzyme complex supplemented through diet will affect the productive indicators of Cobb 500 chickens in Chachapoyas, Peru?
To answer this question, the following hypothesis has been considered: The supplementation of the diet with oregano and an enzymatic complex will allow to determine and evaluate its effect on the productive indicators of chicken meat in a commercial farm in the district of Jazán, Amazonas department.

Objectives:

1. To determine and to analyze the effect on feed consumption.
2. To determine and to analyze the effect on the increment in live weight.
3. To determine and to analyze the effect on feed conversion.
4. To determine and to analyze the effect on bones yield.
5. To determine and to analyze the effect on the perceptions of taste, smell and tenderness on consumers.

METHOD

The present experiment was carried out at the plants of Inveragro San Martín de Porras SAC chicken meat production company, Jazán district, Amazonas. It had an effective duportion (field phase) 42 days, during September and October 2017. These 42 days included: 07 days of the Pre-Start phase (neonatal chickens) (PS), 14 days of the Start phase (SP), 7 of the Growth phase (GP), 7 of Fattening phase (FP) and Finishing (F).

The following processes were evaluated:
P_1: Positive test (diet with AGP)
P_2: Negative test (without AGP)
P_3: 0.005% enzyme complex
P_4: 0.05% oregano
P_5: 0.005% enzymatic complex plus 0.05% oregano
P_6: 0.1% oregano
P_7: 0.005% enzyme complex plus 0.1% oregano.

A total of 280 one-day-old female and male Cobb -500 chickens were used; from the incubator plant of the same company. The feed portion in each stage and process were prepared on the farm with the inputs that were provided by the company's Food Processing Plant.

Table 1 shows the formulas of the feed portions; while in Table 2 shows the proximal composition and the gross energy content (GE).

Table 1
Formulas of the portions used in the animal breeding phases (Kg.)

Supplies	PI	I	C	E	A
Corn	144.4	214.8	225.2	285	337
Broken rice	150	100	100	48.25	---
Soybean meal	135.8	129	117	117	99
Whole soy	30.01	29.73	28.44	16	29.17
Palm oil	---	---	5	10	10
Carbonate Ca	5.22	2.85	2.85	2.68	4.2
Phosbic	10.94	7.27	6.57	6.07	5.5
Dust rice	---	---	---	2.49	2.95
Bovine Hb	6	5	3	2	2
Bovine plasma	6	---	---	---	---
Common salt	1.53	0.9	0.75	0.73	0.69
Premix*	10.06	10.48	11.17	9.78	9.36
Total	500	500	500	500	500

Source. Statistical processing of data.

* Premix: Combination of vitamin products, minerals, antioxidants, acidifiers, mycotoxin trap, coccidiostat, pigments, AGP, etc.

Table 2
Energetic (Mcal/kg) and proximal (%) analysis of the portions used.

Component	PI	I	C	E	A
Protein (Nx6.25)	22.96	20.34	20.22	21.41	17.04
Raw fiber	1.74	1.76	1.41	1.29	1.83
Ashes	4.88	4.4	4.24	4.12	2.76
Ethereal extract	2.61	3.66	4.88	5.05	4.84
Humidity	11.28	10.98	11.96	11.08	10.79
Nifex	56.53	58.86	57.29	57.05	62.74
Calcium	0.78	0.8	0.72	0.75	0.35
Phosphorus	0.65	0.56	0.5	0.49	0.37
Gross energy	4.5	4.54	4.63	4.68	4.81

Source. Statistical processing of data.

The proximal analysis was performed in the laboratory of physicochemical analysis in Montana S. A., located in Lima city. The determination of gross energy was made by calorimetry in the nutrition laboratory of the UNTRM located in Chachapoyas city.

Oregano was purchased at the wholesale market (Moshoqueque) Chiclayo city, region of Lambayeque and it was conditioned (dehydportion and grinding) in the nutrition laboratory of the UNTRM, in Chachapoyas. The enzyme complex ROVABIO® ADVANCE Adisseo's firm, provides xylanases, β-glucanases, debranching enzymes, cellulases, pectinases, proteases.

Nearby Pedro Ruiz town there are one of the farm barn, , the corral were prepared for each one of the aftershocks (28); the corral were made with burlap blanket, fishing nets, wire, wooden stakes, and rice husks; where each corral had an area of 1.2 square meters. Trough and drinker were provided. In addition, an electronic scale was used to weigh food and animals, markers pen, a field notebook, camera and a computer.

As to the techniques, the barn was packed with chicken the same day. But it had been already cleaned, disinfected and led by a sanitary vacuum. All the chicks that were part of the experiment were identified and weighed individually, at the beginning and at the end of each of the productive phases. The information was recorded in a field notebook and then it was noted to an electronic database in Excel.

A random distribution of each of the replicates was performed in the experimental environment (one part of the barn), in two rows of 14 corral each one. Males and females were separated.

The food was prepared in the animal feed plant using a stainless steel horizontal mixer, weighing 100 kilos of payload, and it was cleaned and prepared as the portion of each process. This differences changed due to the presence of oregano, enzymatic complex and the AGP. in the formulas these inputs were within the fraction called Premix.

The food was supplied in order to promote quantities the consumption of ad libitum and the amount consumed by each repetition (corral) was determined by the difference between the offered and the waste.

At the end of the breeding, samples of males and females were taken from each process and those were slaughter to determine the bones yield, it did not include a head-neck, tarsi, or viscera.

The chicken breast were used to carry out the tasting test with boiled breasts using the methodology of descriptive-qualitative analysis described by Char et al. (2016), cited by Yoplac et al. (2017), that methodology was experiment with a panel of 10 semi-trained judges (postgraduate UNTRM students), using an unstructured guideline from 0 to 15, where the smell, taste and tenderness were evaluated. The used scales were: 0, very bad, and 15, extremely good. The score of 7.5 was considered an acceptable average. According to Yoplac et al. (2017), the units are considered as dimensionless. All the chicken breast were prepared in the same way, the exact amount of salt was used, meat cubes of 1 cm on each side were presented and the tasters had water to rinse the mouth from sample to sample.

During the whole productive process, the same sanitary requirements as the farm uses were maintained, both for the farm and the barn. As well as the program of vaccinations, rodents and flies control, cleaning and fumigation.

The following variables were determined and evaluated:

- Feed consumption
- Live weight increment
- Food conversion
- Bones yield
- Perception of smell, taste and tenderness of the meat.

As stated above, feed consumption was determined by the difference between quantities supplied and residues. The live weight increment was determined by each of the productive phases; the feed conversion as the relationship between the number of units of food consumed per unit of live weight increment; the bones yield as the relationship between weight of the bones and live weight immediately before slaughtering; the perception of smell, taste and tenderness were determined by the methodology cited by Yoplac et al. (2017).

The design was used completely randomly for the statistical evaluation of the information, through the analysis of the variance (Cochran and Cox, 2008); previously, the homogeneity of the variances was determined by applying the Bartlett test.

In the case of bones yield, before applying the variance analysis, the information was transformed by the arco-seno correction, to neutralize the typical non-normality of the percentage data that are much higher than 50%.

The disposition to tolerate a maximum probability of 5% of committing alpha type error was maintained.

RESULTS

Feed consumption

The results related to the feed consumption are presented in Table 3. Respectively for the processes from the first to seventh, the total feed consumption per repetition was 43.44, 43.13, 43.95, 43.95, 43.69, 42.99 and 43.86 kilos; the statistical analysis indicated that there were significant differences ($P \leq 0.05$) between processes. The expressed information as total consumption per chicken was 5.11, 4.79, 4.88, 4.88, 4.85, 4.78 and 5.01 kilos.

The statistical difference was established due to the behavior from processes 2 and 6, specifically in the processes 6. Under conditions of a very low variability coefficient (0.96%), small differences are statistically significant. Thus, when performing the percentage comparison between processes with reference (100%) to processes 1 was determined that processes from the second to the seventh represented 99.3, 101.2, 101.2, 100.6, 99 and 101%; it revealed that, in practical terms, consumption was similar; so it can be considered that the feed consumption was not affected by the presence of oregano and the enzyme complex.

It is suggested that the herbs improve and add flavours in the animal feed, therefore, those can influence in the feeding patterns, the secretion of digestive fluids and the total feed consumption. The primary site of activity is the digestive tract. Due to the wide variety of active components, different herbs and spices which affect the digestive processes of digestion in a different way. The herbs can exercise multiple functions in the animal body. Most of them act as sialogogues and stimulate the secretion of saliva, which facilitates swallowing.The extracts of Salvia officinalis, Thymus vulgaris y Rosmarinus officinalis and the mixture of cymophenol, cinnamaldehyde and Capsicum improved the digestibility of the food in broiler chicken.

Also the positive effects of the extracts of plants on the digestibility of nutrients were observed for the properties of stimulation of the appetite and of the digestion and the antimicrobial effects (Hernández et al., 2004). Also an increment of food consumption and in the digestive secretions has been observed in animals to which were provided suplemented food with fitobiotics (Windisch et al., 2008).

If it is assumed an effect about the rate of territory, both of the enzyme complex such as the oregano, it could accept a positive effect on the consumption; nevertheless, it was not demonstrated, it is possible on account of the interaction of the different components of the portion, such as the plasma and the hemoglobin which exercise positive effect on the food consumption (Vásquez, 2017) and the effect of the tested supplements could have been neutralized.

Increase in live weight

The table 4 shows the results relating to the increments of live weight, for each one of the productive phases and the accumulated. The analysis of the variance was applied with the accumulated increment; the differences between the process achieved statistical significance ($P \leq 0.01$); and also the differences between males and females, throw wich was expected every time that the males are more productive due to different factors.

The analysis of covariance was realized between the initial weight (X) and the increments accumulated of live weight (Y) after correcting by default the initial weight, the statistical significance was kept; it was not proceed to make correction by default of the initial weight because the significance of coefficient was analyzed, and the outcomes were no significant. Likewise, residual component of variance was uniformly distributed between the groups of process, which were corroborated for the resemblance to standard diversion of each one of the process and besides the coefficient of general variability was of lacking magnitude (4.7 %).

The processes 7, 5, 3 and 1 reached the largest increment of weight although those were statistically equal between them. The difference between the processes 7, 5 and 3 were very small; while the process 1 included AGP, it was the difference between the process 7 If the AGP were considered as irreplaceable to achieve maximum yields in the chickens meat, it turned out evident that the combination of oregano and the enzymatical complex can do it.

Table 3

Food consumption of meat chicken that received oregano and a enzymatic complex in the food

Aspects	**P_1**	**P_2**	**P_3**	**P_4**	**P_5**	**P_6**	**P_7**
Chickens*	40	40	40	40	40	40	40
Days	42	42	42	42	42	42	42
AGP	Sí	No	No	No	No	No	No
Enzymatic complex, %	No	No	0.005	No	0.005	No	0.005
Oregano, %	No	No	No	0.05	0.05	0.1	0.1
Total consumption/repetition, kg.	43.44^{abc}	43.13^{bc}	43.95^{a}	43.95^{a}	43.69^{abc}	42.99^{c}	43.86^{a}
Total consumption/chicken, kg.	5.11	4.793	4.883	4.884	4.854	4.777	5.012
Average consumption/chicken/ day, g.	121.7	114.1	116.3	116.3	115.6	113.7	119.3

* At the end of every productive phase, were extracting chickens for purposes of necropsy for other studies, finally the experiment there were 9 chickens in every one of the repetitions..

[a, b] Different letters about the averages they indicate significative differences between process (P≤0.05, Duncan).

Table 4

Increase in live weight, average for chicken for productive phase, of meat of chickens, that received oregano and a enzymatic complex in the food.

Aspects	**P_1**	**P_2**	**P_3**	**P_4**	**P_5**	**P_6**	**P_7**
Chickens*	40	40	40	40	40	40	40
Days	42	42	42	42	42	42	42
AGP	Sí	No	No	No	No	No	No
Enzymatic complex, %	No	No	0.005	No	0.005	No	0.005
Oregano, %	No	No	No	0.05	0.05	0.1	0.1
Initial weight, g.	45.4	44.8	44.3	44	44.1	42.4	43.2
Productive phase:							
Pre-start phase	91	87.5	89.8	88.3	88.3	86.5	92.3
Start phase	672.3	647.8	681.5	687.8	677	649.8	680
Growth phase	672.3	629	706.3	632.8	747	664.3	705.5
Fattening	713	681.3	741.8	683.8	704.8	723.8	775.8
Polish off	692.3	706	663.3	725	688.5	686.8	620.3
Accumulated increment	2848.7^{a}	2761.3^{c}	2868.0^{a}	2814.0^{b}	2879.9^{a}	2818.9^{b}	2881.4^{a}
Final live weight, g.	2894.1	2806.1	2912.3	2858	2924	2861.3	2924.6

* At the end every productive phase, were extracting chicken for purposes of necropsy for other studies, finally the test there were 9 chickens in every one of the repetitions.

[a, b] different letters about the averages they indicate significative differences between process (P≤0.05, Duncan).

The processes 6, 4 and 2 reached minor increments of weight, especially the process 2; this was to be expected since this one was considered to be the " negative test ", since it did not include AGP, oregano and enzymatic complex. In relation to the process 7; the 6, 4 and 2 reached respectively accumulated lower increments in 2.2, 2.3 and 4.6 %.

Under conditions of food consumption very similar to the best weight increments in animals of very close genetic baggage are based on the best digestion, absorption and anabolic utilization of the nutrients. So, it is not surprising that the two processes that achieved the best weight increments, these combined oregano and enzyme complex.

Oregano is a carrier of substances such as carvacrol and thymol, between other principles, which can diminish the viscosity of the digesta improving the digestion, action complemented by the enzymatic complex, that assumes actions of degradation of the Nonstarch polysaccharides (NSPs) diminishing also the viscosity of the intestinal content. With an healthy intestinal epithelium is more efficient the absorption of nutrients and its movement towards the organs, like the liver, where are realized the anabolic reactions that will allow the geneportion of more muscle tissue.

On the other hand, the powerful antioxidant action attributed to the principles contained in oregano would avoid the damage of the tissues and, in consequence, nutrients would not be destined for the repaportion but they would use for the synthesis of new tissues (major production),for example it can be corroborated in the excellent review published by Bhatt (2015), where there is highlighted the role of herbs and herbal supplements in the animal nutrition.

Feed conversion

The table 5 were obtained the results obtained with the food conversion of each one of the productive phases, as well as with the accumulated value.
The statistical analysis showed that the differences between processes for each of the productive phases, as well as with the accumulated value, did not reach statistical significance; but with important behaviors, as to be discussed in some detail.

In the Pre-Start phase (the first 7 days of age) the highest efficiency in the use of food to increment live weight was exhibited by process 1 (positive test), which included AGP in the feed, the company employs two AGP; at this age, where exist the colonization of the intestine by different bacterial species, AGP showed its greatest efficacy; however, it does not mean that it is better in the following productive phases. The process 7 was closer to combine the highest proportion of oregano with the enzyme complex; with a higher proportion of oregano, the inhibitory capacity of bacteria would enhance and adequate use of the food would be allowed.

In the start phase (from 8 to 21 days of age) all process (including the negative test) were more efficient in the use of the food than the positive test. If the process that does not have AGP behaved better than the process that has AGP, That indicates the AGPs have generated resistance in the colonizing bacteria of the intestine. In this phase, process 4 showed the highest efficiency using of food to increment live weight; however, it should be considered all process showed outstanding values. It is evident that the AGP can be replaced by oregano and the enzyme complex and its use is not strategic.

In the Growth phase, as in the previous phase, all processes outperformed the control [U1] processes (positive and negative), mainly the processes 5 and 7 (in both, combined use of oregano and enzymatic complex were used) which surpassed the positive test by 15.7 and 15%, respectively, and the negative test by 12.4 and 11.7%, respectively.

In the fattening phase, as is natural, the feed conversion values become less efficient, which is due to the age of the chickens and the greater health challenge that the production process itself represents for them. In this phase the positive test again exceeded the negative, which could be due to the application of a process in the drinking water for the barn; however, processes 5, 6 and 7 were more efficient, especially process 7, which was more efficient than negative test and positive test in 11.3 and 10%, respectively. When chicken grows into older age, mainly fattening and finishing, it is subjected not only to a greater bacterial

attack but also free radicals play an important role in the efficiency of use of the food, therefore we assume that it is not only to control bacteria but to mitigate the effect of stress-causing factors that are conducive to the presentation of free radicals.

The Finishing phase is the most difficult for the meat chicken, due to the efficiency of utilization of the food deteriorates considerably. Process 4 (0.05% oregano) was the one that behaved best in this phase.

While considering the accumulated feed conversion (the reference for most producers) the best values were achieved by processes 3 (0.005% of enzymes) and 6 (0.1% of oregano) that exceeded the controls between 2 and 6 %.
Even when statistically significant differences were not obtained, a difference of 3% or more may represent the difference between a mediocre productive process and a successful one; Since feed conversion has a significant influence on the economy of food, the cost of food represents around 65% of the total cost of production, for this reason we try to achieve the highest efficiency in the use of food. To achieve safe meat for the consumer in the poultry industry, it is being placed on the antioxidant action of natural substances.

It has been indicated that it is necessary to evaluate the antioxidant status of the available food and the antioxidant status of animals to combat the different types of stress contracted by animals to obtain the maximum benefit either by means of milk, meat or wool. Under physiological conditions, animals constantly produce reactive oxygen species (ROS). Low ROS concentrations are essential for several physiological processes, including protein phosphorylation, activation of transcription factors, cell differentiation, apoptosis, oocyte maturation, steroid-genesis, cellular immunity and cellular defense against microorganisms. However, the cellular access concentration of ROS, If these are endogenous or nutritional, they must be eliminated by the organism (Miller et al., 1993).

As most of people known, oxidative stress refers to the lack of balance between ROS production and the level of antioxidants, which results the oxidative alteportion of biological macromolecules such as lipids, proteins and nucleic acids. Likewise,the domestic animals are frequently exposed to oxidative stress, especially in intensive breeding systems. Oxidative stress is responsible for numerous disease processes in animals, including sepsis, mastitis, enteritis, pneumonia, respiratory and joint diseases (Favier, 1997, Aurousseau, 2002, Lykkesfeldt and Svendsen, 2007).

Regarding the origin of antioxidants carried by herbs and spices, numerous secondary metabolites formed have been determined by plants serve as defense agents against physiological and environmental stressors, predators and pathogenic microorganisms.

The main molecules accountable for the antioxidant properties of herbs and spices are phenolic substances (flavonoids, hydrolysable tannins, proanthocyanidins, phenolic acids and phenolic terpenes) and some vitamins (A, E and C). Herbs rich in phenolic compounds are frequently used: Rosmarinus officinalis, Thymus vulgaris, Origanum vulgare, Salvia officinalis, Camellia sinensis, Taraxacum officinale, and Ginkgo (Halliwell et al., 1995. Craig, 2001; Ćetković et al., 2004, Fasseas et al., 2008)

Many active components of herbs and spices can prevent the lipid peroxidation through the attenuation of free radicals, or by the activation of antioxidant enzymes such as superoxide dismutase, catalase, glutathione peroxidase and glutathione reductase. At the cellular level, oxidation of fatty acids (FA) refers to the lipoperoxidation as well, which is a consequence as a result of oxidative stress, and to auto biological propagante reaction initiated by ROS (reactive oxygen species), which eliminate protons from FA (fatty acids), the more susceptible is the FA polyunsaturated belongs to the family n-3 (PUFAs n-3) (polyunsaturated fatty acids (n3).

At the level of the living organism, lipid peroxidation has been implicated due to the deterioration of physiological functions which include the growth and the reproduction, as well as in the immunity that leads to an incremented susceptibility infectious disease (Miller and Brzezinska-Slebodzinska, 1993; kamal-eldin and Yanishlieva, 2002; Niki et al., 2005).

Table 5
Feed conversion, average per productive phase, of meat chickens which received oregano and an enzymatic complex in the feed

Aspects	**T_1**	**T_2**	**T_3**	**T_4**	**T_5**	**T_6**	**T_7**
Chickens*	40	40	40	40	40	40	40
Days	42	42	42	42	42	42	42
AGP	Sí	No	No	No	No	No	No
Enzymatic complex, %	No	No	0.005	No	0.005	No	0.005
Oregano, %	No	No	No	0.05	0.05	0.1	0.1
Productive phase:							
Pre-start phase	1.169[a]	1.190[a]	1.181[a]	1.232[a]	1.222[a]	1.192[a]	1.171[a]
Start phase	1.488[a]	1.465[a]	1.470[a]	1.463[a]	1.466[a]	1.474[a]	1.475[a]
Growth phase	1.694[a]	1.630[a]	1.492[a]	1.630[a]	1.428[a]	1.540[a]	1.440[a]
Fattening	1.894[a]	1.922[a]	1.824[a]	1.956[a]	1.885[a]	1.820[a]	1.704[a]
Polish off	2.680[a]	2.038[a]	2.197[a]	1.998[a]	2.637[a]	2.041[a]	2.867[a]
Accumulated increment	1.820[a]	1.737[a]	1.707[a]	1.741[a]	1.746[a]	1.702[b]	1.745[a]

***** At the end of each productive phase, chickens were extracted for necropsy purposes for other studies. At the end of the experiment there were 9 chickens in each repetition.

[a] Equal letters on the averages, indicate non-significant differences between the processes (P>0.05).

Table 6

Bones yield and sensory perception of chicken meat which received oregano and an enzyme complex in the feed.

Aspects	**T_1**	**T_2**	**T_3**	**T_4**	**T_5**	**T_6**	**T_7**
Chickens*	4	4	4	4	4	4	4
Days	42	42	42	42	42	42	42
AGP	Sí	No	No	No	No	No	No
Enzymatic complex, %	No	No	0.005	No	0.005	No	0.005
Oregano, %	No	No	No	0.05	0.05	0.1	0.1
Bones weight, g.	1992[a]	1943[a]	1983[a]	1977[a]	2135[a]	2037[a]	2058[a]
Bones yield, %	67.7[d]	66.1[e]	68.7[cd]	69.6[bc]	71.0[ab]	70.1[abc]	71.4[a]
Sensory perception:							
Odor	8.39[a]	7.75[a]	8.76[a]	7.98[a]	8.24[a]	8.48[a]	8.41[a]
Flavor	8.46[a]	7.33[a]	8.06[a]	8.61[a]	7.52[a]	8.25[a]	7.78[a]
Tenderness	8.89[abc]	7.84[c]	9.82[ab]	8.28[bc]	10.47[a]	9.40[abc]	8.87[abc]

[a, b] Different letters on the averages, indicate significant differences between processes (P>0.05, Duncan).

Lipoperoxidation works within a synergistic system of antioxidant compounds, as well as exogenous and endogenous to the body. A surplus of exogenous antioxidants has only a limited capacity to defend the body from deleterious ROS. The ultimate objective of any antioxidant supplement must be regular to the increment of the entire system, which is regulated by a series of vias, despite the several fact of the supplements are not similar. Vitamin E is a synthetic antioxidant, which is commonly used in animal nutrition, but its bioefficiency is limited when the consumption of n-3 PUFAs is incremented.

Furthermore, it has been reported about the prooxidant action when high doses, or in the absence of other antioxidants capable of recycling the oxidized form of vitamin E are ingested.

Therefore, to optimize the antioxidant protection of animals which have been fed with nutritional diets in n-3 PUFA, it would be better to use other antioxidants, instead of increasing the intake of vitamin E which can be ineffective or even harmful to animals. The experiment of feeding with poultry showed that the plant extracts were obtained from Origanum vulgare, which prevented the lipoperoxidation in the muscle tissues and those can be complementary to vitamin E (Harris, 1992; Mukai et al., 1993; Allard et al., 1997; Papageorgiou et al., 2000; Young et al., 2003; Giannenas et al., 2005; Harnafi and El Amrani, 2007).

Improvement in feed conversion in chicken meat as a result of the use of fitobiotics, have been reported by grashorn (2010), Ganguly and Roy (2014), Jameel et al. (2016), Prabakar et al. (2016).

Bones yield

Table 6 shows the results obtained by bones yield. The statistical analysis indicated that the differences between processes for bones yield(%) were significant ($p \leq 0.01$). The best yield of bones (over 70%) were achieved in the processes 7, 5 and 6; while the lowest results corresponded to the processes 1 and 2 (positive and negative tests, respectively).

In this variable the results indicate that the oregano and the enzyme complex allowed a greater synthesis of muscle tissue at the level of breast and legs, which are the predominant bones.

Some researches who worked with supplements of digestive enzymes and essential oils (such as those from the oregano) have indicated that the antioxidant activity can decrease the nutrients expenditure in the repair tissue at the level of the gastrointestinal tract, as a result would be achieved tracts healthier and lighter weight; what would be supplemented by the action of enzymes. The action of the contents in the oregano has been reported, and it can stretch out the intestinal villi and reduce the depth of the crypts (Prabakar et al., 2016), so it could be assumed a better bones yield because of its use in the diet.

Sensory perception of the meat

The results obtained with the perception of smell, taste and tenderness of the meat are shown in Table 6. All of the values for the three variables were above 7.5, considered by Yoplac et al. (2017) as an acceptable average according to the technique used to quantify the perception.

The statistical analysis determined that between processes in the smell and taste were not significant differences. However, the differences were significant ($p \leq 0.05$) when the tenderness was assessed. The processes with higher averages were 5, 3 and 6; and the lowest average process was negative 2 (negative witness). The background research experienced with broilers and turkeys in Lambayeque (Perleche, 2002; Adrianzén, 2003; Clavo, 2014; Leyton, 2014; Soplopuco, 2014; Collantes, 2017; Niquén, 2017; Romero, 2017) it shows the meat of the animals that received fitobioticos tend to have a greater degree of consistency, which in the chicken is something significant, due to the fact that consumers believe that the chicken meat is too soft and looking for a better consistency, so they associate with poultry meat, to which they consider to be the best flavor.

Prabakar et al. (2016) has indicated that It is likely that the reason for these processes is due to the action of the principles to improve the availability of factors that maintain the integrity of the muscle cells.

As well, the use of enzymes and oregano in the feeding of meat chicken are perceived as beneficial for the poultry industry and for consumers, when the non-use of AGP are not added.

CONCLUSIONS

Under the conditions in which this research was made, these are the conclusions:

The incorporation of oregano and a enzyme complex in the diet of chickens meat did not impact on the feed consumption.

The increments in live weight had not affected when those eliminated the AGP and replaced them with oregano and enzyme complex, indicating that those can be replaced.

The feed utilization efficiency to increment the live weight was improved by oregano, or by enzyme complex.

The use of the combination of 0.1% of oregano and 0,005% of enzyme complex significantly improved ($P \leq 0.05$) the bones yield.

The smell, taste and tenderness of the meat remained above the acceptable degree; rosemary and enzyme complex to improve the consistency of the chicken breast.

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