Acta Agronómica (2019) 68 (4) p 312-318 ISSN 0120-2812 | e-ISSN 2323-0118 doi: https://doi.org/10.15446/acag.v68n4.72174

Effect of *Mentha spicata* L. infusión on the productive performance and organoleptic characteristics of Cobb 500 broilers

Efecto de la infusión de *Mentha spicata* L. en el rendimiento y las características organolépticas de canales de pollos de engorde Cobb 500

Angel Roberto Sánchez Quinche[1], Julia Cristina Solórzano Saldarriaga[1], José Nicasio Quevedo Guerrero[2], José Roberto Paladines Romero[1], Ion Pérez Baena[3].*

1.School of Veterinary Medicine and Animal Husbandry, Universidad Técnica de Machala, Ecuador. 2.School of Agronomical Engineering. College of Agricultural Sciences. Universidad Técnica de Machala, Ecuador. Research Group on Food Production and Animal Health (GIPASA). 3.Institute of Animal Science and Technology. Universitat Politécnica de Valencia, Spain. [*]Author for correspondence: arsanchez@utmachala.edu.ec

Rec.: 2019-05-10 Acep.:2019-12-19

Abstract

The objective of this research was evaluate the effect of *Mentha spicata* L. infusion on the productive performance and organoleptic characteristics of Cobb 500 broilers. The management, biosecurity and welfare of birds for open houses systems were followed using a completely random design (CRD). In order to evaluate treatments effects during 35 days, 200 1-day-old mixed chickens were distributed in five treatments, with four réplicas, of 10 birds each in the following groups: T_1 (control), T_2 (*M. spicata* infusion at 10%), T_3 (*M. spicata* infusion at 20%), T_4 (*M. spicata* infusion at 30%) and T_5 (*M. spicata* infusion at 40%). The variables studied were broilers productives performance, carcass weight, abdominal fat and organoleptic characteristics. The data was processed using statistical program Statgraphics Centurión XV.I, performing a multivariate analysis of variance and determining the factors with effect, and ANOVA of productive variables per week; contingency tables were prepared with organoleptic indicators data to determine differences (Chi-square test). Results show no effect on productive parameters up to 30% per liter because a decrease in feed consumption in the slaugther week for T_5 (40% of infusion) which indicate a limit of infusion use; the principal effects on infusion *M. spicata* L was on abdominal fat which was lower thickness in T_4 (30%) and T_5 (40%) maybe due to the presence of flavonoids in the mint plant, which have a positive effect on lipid metabolism, resulting in a lean product. Flavor, tenderness and juiciness showed a favorable acceptance for meat of animals recibing the infusion treatements in relation to the control group due to the tendency of the majority of the Ecuador population to consume products with markables organoleptics characteristiques coming from animals raised in tradicional form.

Key words: Broilers, abdominal fat, carcass weight and quality, organoleptic characteristics.

Resumen

El objetivo de esta investigación fue evaluar el efecto de la infusión de la menta (*Mentha spicata* L.) en el rendimiento y las características organolépticas de canal de pollos de engorde Cobb 500. Se siguió el manejo, la bioseguridad y el bienestar de las aves para los sistemas de casas abiertas utilizando un diseño completamente al azar (DCA). Para evaluar los efectos de los tratamientos durante 35 días, se distribuyeron 200 pollos mixtos de 1 día, en cinco tratamientos, con cuatro réplicas, de 10 aves cada uno en los siguientes grupos: T1 (control), T2 (infusión de *M. spicata* al 10 %), T3 (infusión de *M. spicata* al 20%), T4 (infusión de *M. spicata* al 30%) y T5 (infusión de *M. spicata* al 40%). Las variables estudiadas fueron: rendimiento de pollos de engorde, el peso de la canal y las características organolépticas. Los datos se procesaron utilizando el programa estadístico Statgraphics Centurión XV.I, realizando un análisis multivariado de la varianza y determinando los factores con efecto, y un Anova por semana para las variables productivas; se elaboraron tablas de contingencia con los datos de los indicadores organolépticos para determinar las diferencias (Prueba de Chi-cuadrado). Los resultados no mostraron efecto sobre los parámetros productivos hasta la dosis de infusión de 30% por litro debido a una disminución en el consumo de alimento en la semana de sacrificio para T_5 (40% de la infusión), lo que indica un límite en el uso de infusión. Los principales efectos de la infusión de *M. spicata* L. ocurrieron en la grasa abdominal, que presentó menor espesor en T_4 (30%) y T_5 (40%), posiblemente por la presencia de flavonoides en la planta de menta, que tienen un efecto positivo en el metabolismo de los lípidos, resultando un producto magro. El sabor, la terneza y la jugosidad mostraron una aceptación favorable para la carne de animales que recibieron los tratamientos de infusión en relación con el grupo control, de acuerdo con la preferencia de la mayoría de la población de Ecuador por productos con características organolépticas procedentes de animales criados en forma tradicional.

Palabras clave: Pollos de engorde, grasa abdominal, peso y calidad de la canal, características organolépticas.

Introduction

The need for the consumption of animal protein is constantly increasing, mainly due to the demographic growth of the population. This increase in demand means that the livestock production sector must continuously make improvement actions to increase industrial yields. In addition to this situation, the trend of today's society that demands safe meat, from farms that comply with quality and biosecurity regulations and specially apply and respect animal welfare, taking an increasingly growing interest in ecological management of the animals.

It is notorious the increasing demand for poultry products, as an alternative to red meats, which can promote diseases, such as diverticulosis (Böhm, 2015), diabetes (Pan et al., 2013) and the increased risk of suffering cancer (Wie et al., 2014). Under these circumstances of market demand, a lot of work has been done on genetic selection of birds (Sheng et al., 2015; Stratmann et al., 2016), especially in broiler (González-Cerón et al., 2015; Reyer et al., 2015), with the aim of obtaining a meat product in the shortest possible time and the reduction of the resources used in their production.

Increasing the production of poultry meat for the current demand, is no longer the only goal that the industry proposes, since it must consider demands of the market. This raises a reorganization of the production matrix, given that production systems must consider ecological aspects (Onrust et al., 2015; Ricke, 2015), and this is why the broilers industry has to evolve according to the market trend, becoming a great challenge for bird producers. It is meritorious all the research that has currently done in the area of new alternatives for avian management; and specially to replace artificial chemicals; such as antibiotics (Diaz-Sanchez et al., 2015) that can cause problems in the consumer's organism.

The disadvantage of finding traces of residues of different chemicals used in normal management for the production of white meat consumption is not the result of the absence of regulations that govern a country or international, because by law, these are worldwide. Rather, it arises when drug withdrawal times is not correctly established at the farm level (Beyene, 2016; Muhammad Danish Mund et al., 2017).

Although many replacement alternatives are currently used, combinations with artificial chemical substances also stand out (Samant et al., 2015), to look for possible effects with their administration. Aditionally, it has been increased consumption of traditional foods, and it seems a return to flavors and colors reminiscent of field products. This is why research with medicinal plants attracts a lot of attention (Babak and Nahashon, 2014; Chiriboga Chuchuca et al., 2016; Sánchez et al., 2016), given the advantages they are showing and especially because it is a resource from which numerous active principles are being obtained due to the great variety of species that exist in the world.

In the present research was used *Mentha spicata* L. a Lamiaceae family, also known as mint, a perennial creeping plant with a fresh and intense aroma. This plant is traditionally used in Ecuador and other Latin American countries as a medicinal herb, in infusion, for the treatment of stomach disorders, diarrhea, coughing, wound healing due to it's extraordinary source of aromatic compounds and essential oils containing biologically active constituents that possess antimicrobial action and insect repellent (Quevedo Guerrero, 2017). The general objective was evaluate the effect of the infusion of *M. spicata* L. on the performance and organoleptic characteristics of Cobb 500 broilers.

Materials and methods

The research was carried out at the Granja Santa Inés of the Agricultural Faculty of Sciences of the Universidad Técnica de Machala ubicate in Machala – Pasaje way, Machala Canton, Province El Oro, coastal region of Ecuador, in the geographic coordinates 79º 54' 05" longitude northeast and 3º 17› 16» south latitude. The enviromment temperature fluctuates from 22 to 35°C, in an altitude of 5 meters. Were adopted all possible management and biosecurity norms, for open cages in order to maintain total welfare in the birds. The disinfection of the vessel with formaldehyde and application of quicklime to the floor before the chickens enter. Wood chip was use as a litter, basic vaccination schedule was aplallied (New Castle 'La Sota' and Gumboro D78) and no antibiotics was administere. Two hundred 1-day-old mixed chickens of the COBB 500 line were distribute in five treatments, each with four replicates of 10 birds. Those were randomly assigne (40 birds per treatment) as following: T1 control, T2 (*M. spicata* L. infusion at 10%), T3 (*M. spicata* L. infusion at 20%), T4 (*M. spicata* L. infusion at 30%) and T5 (*M. spicata* L. infusion at 40%). The infusion was offert as driking water. Animals were feeding with a commercial feed Proaves (Pronaca – Ecuador) ad libitum according the age. Treatments were evaluate for 35 days; a 100-watt yellow bulb provided the heat source for each replica (10 chickens). For the preparation of the infusion of mind was applied the Chiriboga Chuchuca et al. (2016) methodology.

The variables measuring were releated with productives parameters: feed intake, water consumption, feed conversión ratio, mortality, live weight evolution, weight before slaughter, carcass weight, blood weight, weight feathers, weight visceras except lungs and kidneys, weight of head-neck and paws, average thickness of abdominal fat and organoleptic characteristics, flavor, tenderness and juiciness of breasts meat. To measure the weight of chickens and feed was use an electronic scale CAMRY model EK9332-F302 with a maximum capacity of 5 Kg and an error margin of ± 1 g. For water consumption, was used a container of volume with minimum measurements of 10 ml and for fat measuring was employed a digital calibrator.

Feed intake was weekly-recorded (10 chickens per replica) generating 100 data (5T x 4R x 5w), applying the equation 1:

$$Feed\ intake(g) = offered\ feed - leftover\ feed \quad \textbf{Eq. 1}$$

The water consumption was weekly measured (10 chickens per replica) registering 100 data (5T x 4R x 5w), with the equation 2:

$$Water\ consumption(ml) = offered\ water - leftover\ water \quad \textbf{Eq. 2}$$

The feed conversion ratio was weekly measured (10 chickens per replica) recording 100 data (5T x 4R x 5w), with the equation 3:

$$Feed\ Conversion\ Ratio = \frac{Total\ feed\ consumed\ (g)}{(Final\ live\ weight\ (g) - Initial\ live\ weight\ (g))} \quad \textbf{Eq. 3}$$

The mortality of the birds, as a percentage, was obtaine by dividing the dead birds for which they started the trial, with the equation 4:

$$Mortality\ (\%) = \frac{Number\ of\ dead\ chickens}{Number\ of\ chickens\ started} x\ 100 \quad \textbf{Eq. 4}$$

the live weight of the broilers was determined weekly until day 35, registering individually and expressed in grams, with this 1000 data were obtained (5T x 4R x 10c x 5w) without discounting the mortality registered in the investigation.

To determine the yield of the carcass in grams, at day 35 of age, after fasting for 12 hours, broilers were slaugthered by cervical dislocation with suspension of the bird (hanging) for cutting the left jugular and bleeding for two minutes, and then underwent a blanching process at 60 °C. for approximately 30 seconds. Two birds per replicate, taken at random for 40 chickens (5T x 4R x 2c), to obtain weight data post-bleeding, post plucking, post-evisceration. For measuring thickness of abdominal fat, a digital caliper 0-150 mm (TACTIX Mark) was applie directly on it with moderate pressure. Weight data was obtaine from head-neck-legs, wings, thighs, drumstick, shoulder, rump and breast (fresh, frozen, boneless and cooked). In addition, were recorded water losses by cooking the meat, taking the frozen breasts and left them at room temperature for two hours, then proceeded to make cuts of 1 cm of thick. Breasts were place in baking shells identified individually, and then placed in a pot containing boiling water for 10 minutes. They were remove from the fire and the subsequent processes were continue, obtaining 600 data (5T x 4R x 2c x 15v).

For organoleptic characteristics, 105 personal surveys were carried out with standard discrimination questions applied to the consumer tasting methodology, giving a total of 2100 responses (5T x 105p x 4C), they were evaluated qualitatively in meat samples from the 5 treatments: flavor, tenderness, juiciness and smell, for all the pleasant and unpleasant criterion was applied.

Experimental design. For the research, was used a completely randomized design (CRD), with five treatments, each with 4 replicas of 10 chickens, for 40 birds per treatment. The treatments design was as follows: T1 = Balanced feed only, T2 = Balanced feed + 2 ml of M. *spicata* L. infusion at 10% was administered per liter of drinking water, T3 = Balanced feed + 2 ml of *M. spicata* L. infusion at 20% was administered per liter of drinking water, T4 = Balanced feed + 2 ml of *M. spicata* L. infusion at 30% was administered per liter of drinking water, and T5 = Balanced feed + 2 ml of *M. spicata* L. infusion at 40% was administered per liter of drinking water.

Statistical analysis. The statistical analyzes were carried out according to Blasco (2010), a multivariate variance analysis was used for the variables under study and to determine which factors have a statistical effect on the variables. For live weight, feed intake, water consumption and feed conversión ratio was used an analysis of parametric variance (Anova one-way) per week, after checking the assumptions of normality and homocedasticity. To establish statistical differences between treatments Tukey's honest significant difference procedure (HSD), at a confidence level of 95.0% was use. For the analysis of criterio consumer, contingency tables were elaborate and chi-square test was use to establish the differences between treatements. All the analysis was carrie out using the statistical program Statgraphics Centurión XV.I. ®.

Results and Discussion

Feed intake, water consumption, and feed conversión ratio

When performing multivariate analysis of variance in feed intake, it showed a significant diference in the week*treatment interaction. An additional Anova analysis was performed per week. Table 1 shows the averages of feed intake, with their intervals of confidence. From the first week, were detected statistical differences, being the T5 the one that maintained it until the end of the experiment (T5: 32525.8 ± 645.8^{b} vs T1: 34248.5 ± 645.8^{a}). In this treatment, lower intakes were detected, and this agrees with the results found by Darabighane et al. (2017). In that experiment using male broiler Ross 308, they evaluated a fresh leaves of *Mentha piperita* and the gel contained in the leaves of *Aloe barbadensis*, added in the feed, to compare it with an antibiotic, used as a growth promoter.

The water consumption did not show significance in their interaction, however, when was analyzed the data per week, it showed that birds in T4 consumed less water (T1: 14578.3 ± 792.7^{a}, T2: 14001.5 ± 792.7^{ab}, T3: 14064.3 ± 792.7^{ab}, T4: 12838.5 ± 792.7^{b}, T5: 13289.3 ± 792.7^{ab}) than T1 (Table 2). The feed conversion ratio did not show a significant statistical difference in their interaction. But when week effect was analyzed, statistical differences were observed in T1 and T3, but at the end of the experiment, no differences were detected (Table 3). These results agree with those found by Ameri et al. (2016), who administered dried ground leaves of *Mentha piperita* in the feed of broilers Ross 308 to evaluate performance, body temperature and the characteristics of the carcass.

Mortality

For all treatments the mortality observed in this researh was as expected for tropical zones (less than 5%), therefore this variable was not influenced by treatments. This result is similar to that reported by Chiriboga Chuchuca et al. (2016) who spreng an infusion of *Plectranthus amboinicus* (Lour.) and vinegar in chickens *Gallus gallus* domesticus in the drinking wáter, without no reporting an effect in this variable.

Live weight

When was analyzed the interaction of the live weight per week there were no significant statistical differences. After, analyzed the data per week, it was observed that there is no significance throughout the duration of the experiment (Table 4), agreeing with those results of Ameri et al. (2016), Chiriboga Chuchuca et al. (2016), Sánchez et al. (2016), the latter administered to Cobb 500 chickens, 3 ml of 10% infusions of *Cymbopogon citratus* (DC.) Stapf., *Plectranthus amboinicus* (Lour.), and *Tilia cordata* (Mill.) per liter of drinking water and they did not report differences in the weights of the birds. However, Darabighane et al. (2017) reported differences at the beginning, in the growth and in the total weight of the birds.

Carcass yield

Table 5 shows the data obtained measuring the weighing of broilers before slaughter, and after substracting blood, feathers and the head-neck-paws weight. No statistical differences were detected; but, the visceral weight (T1: 305.8 ± 37.8^{a}, T2: 239.5 ± 37.8^{ab}, T3: 212.3 ± 37.8^{b}, T4: 190.3 ± 37.8^{b}, T5: 247.3 ± 37.8^{ab}) and abdominal fat thickness were different (T1: 4.95 ± 0.79^{a}, T2: 4.17 ± 0.79^{ab}, T3: 4.49 ± 0.79^{ab}, T4: 2.90 ± 0.79^{c}, T5: 3.31 ± 0.79^{bc}). Regarding the weight of wings, thighs, counter-thighs, shoulder, rump, breast, frozen breast, water loss by defrosting breast, boneless breast and cooked breast showed no significance. Table 6 show the data obtained for chicken breasts, only detecting significant statistical difference in the breast bone (T1: 51.25 ± 3.43^{a}, T2: 50.88 ± 3.43^{a}, T3: 45.75 ± 3.43^{ab}, T4: 47.25 ± 3.43^{ab}, T5: 43.38 ± 3.43^{b}) and the water losses of the breasts subjected to cooking (T1: 38.88 ± 4.41^{ab}, T2: 41.38 ± 4.41^{a}, T3: 33.38 ± 4.41^{ab}, T4: 30.25 ± 4.41^{b}, T5: 31.38 ± 4.41^{b}). The variables that show statistical differences tend to decrease, since they are the groups that received the infusion. This differs from that mentioned by Khursheed et al. (2017), who did not find significant statistical differences in data obtained from the commercial broiler chicken channel in an experiment where fresh mint leaves were administere with and without enzymatic supplementation to evaluate blood biochemistry, carcass characteristics and sensory attributes. It also differs from that reported by Ameri et al. (2016), regarding to the characteristics of the carcass.

Organoleptic characteristics

Regarding the taste of meat, not significant statistical differences between treatments was report. The flavor (Figure 1) of all the meats were agreeable for the majority of the respondents (T 1: 85, T 2: 93, T 3: 100, T 4: 94 and T 5: 103), when comparing with the control, all treatments showed an arithmetic difference, but only were detectec statistical differences between T3 and T5. The results of tenderness by criterio of meat mastication (Figure 2) show that the majority of respondents find it pleasant for all treatment whit statistical difference to T4. The juiciness (Figure 3) shows arithmetical differences in all treatments being pleasant for the majority of respondents, but statistically, T3, T4 and T5 differ from the control. These results differ from those reported by Khursheed et al. (2017), who used a panel of experts, not find significant statistical differences from sensory analysis of meat. Meat colour was not evaluate.

Table 1. Averages of weekly acumulative feed intake (g).

Treat.	Week				
	1	2	3	4	5
1	1692.5 ± 49.9[a]	5221.3 ± 48.5[a]	11940.3 ± 143.4[a]	22061.3 ± 643.2[a]	34248.5 ± 645.8[a]
2	1590.5 ± 49.9[a]	5123.5 ± 48.5[bc]	11751.3 ± 143.4[a]	21441.5 ± 643.2[ab]	33901.0 ± 645.8[a]
3	1565.0 ± 49.9[b]	5155.3 ± 48.5[ab]	11720.8 ± 143.4[a]	21369.3 ± 643.2[ab]	33824.3 ± 645.8[a]
4	1582.0 ± 49.9[b]	5114.8 ± 48.5[bc]	11763.8 ± 143.4[a]	21722.3 ± 643.2[a]	34187.8 ± 645.8[a]
5	1530.0 ± 49.9[b]	5056.5 ± 48.5[c]	10374.0 ± 143.4[b]	20197.5 ± 643.2[b]	32525.8 ± 645.8[b]

Difference superindice, statistical differences (P < 0.05).

Table 2. Average accumulated weekly water (ml) consumption.

Treat.	week				
	1	2	3	4	5
1	4722.0 ± 348.3[a]	14578.3 ± 792.7[a]	30169.3 ± 1340.5[a]	55508.3 ± 2584.4[a]	94309.5 ± 3455.8[a]
2	4795.0 ± 348.3[a]	14001.5 ± 792.7[ab]	30280.5 ± 1340.5[a]	53692.0 ± 2584.4[a]	91544.0 ± 3455.8[a]
3	4740.0 ± 348.3[a]	14064.3 ± 792.7[ab]	30113.3 ± 1340.5[a]	54940.5 ± 2584.4[a]	93045.8 ± 3455.8[a]
4	4393.5 ± 348.3[a]	12838.5 ± 792.7[b]	27864.0 ± 1340.5[a]	51029.3 ± 2584.4[a]	88902.8 ± 3455.8[a]
5	4604.5 ± 348.3[a]	13289.3 ± 792.7[ab]	27964.3 ± 1340.5[a]	52758.5 ± 2584.4[a]	91613.5 ± 3455.8[a]

Difference superindice, statistical differences (P < 0.05).

Table 3. Averages of the weekly feed conversion ratio.

Treat.	week				
	1	2	3	4	5
1	0.90 ± 0.04[a]	0.94 ± 0.03[a]	1.15 ± 0.06[ab]	1.42 ± 0.08[a]	1.54 ± 0.08[a]
2	0.83 ± 0.04[ab]	0.92 ± 0.03[a]	1.22 ± 0.06[b]	1.34 ± 0.08[a]	1.55 ± 0.08[a]
3	0.82 ± 0.04[ab]	0.94 ± 0.03[a]	1.19 ± 0.06[b]	1.34 ± 0.08[a]	1.57 ± 0.08[a]
4	0.84 ± 0.04[ab]	0.95 ± 0.03[a]	1.24 ± 0.06[b]	1.40 ± 0.08[a]	1.61 ± 0.08[a]
5	0.81 ± 0.04[b]	0.93 ± 0.03[a]	1.05 ± 0.06[a]	1.29 ± 0.08[a]	1.48 ± 0.08[a]

Difference superindice, statistical differences (P < 0.05).

Table 4. Averages of the weekly live weights (g) of birds.

Treat.	Week				
	1	2	3	4	5
1	187.6 ± 4.9[a]	494.3 ± 13.2[a]	997.2 ± 30.1[a]	1482.1 ± 42.8[a]	2128.4 ± 71.6[a]
2	179.8 ± 5.0[a]	483.8 ± 13.9[a]	993.9 ± 31.8[a]	1506.3 ± 45.1[a]	2173.5 ± 75.4[a]
3	183.1 ± 4.9[a]	480.1 ± 13.2[a]	998.7 ± 30.1[a]	1477.6 ± 42.8[a]	2126.9 ± 71.6[a]
4	184.1 ± 5.0[a]	486.1 ± 13.5[a]	1007.5 ± 31.3[a]	1533.9 ± 45.1[a]	2144.1 ± 75.5 [a]
5	180.5 ± 4.9[a]	472.6 ± 13.2[a]	996.1 ± 30.1[a]	1497.2 ± 42.8[a]	2149.3 ± 71.6[a]

Difference superindice, statistical differences (P < 0.05).

Table 5. Data obtained with the slaughter of the birds on day 35.

Treat.	W. Slaugh. (g)	Blood (g)	Feath-ers (g)	Viscera (g)	Heat-neck-paws (g)	Abd.Fat (mm)
1	2339.1 ± 187.7[a]	86.4 ± 22.4[a]	99.6 ± 39.1[a]	305.8 ± 37.8[a]	179.6 ± 28.2[a]	4.95 ± 0.79[a]
2	2429.5 ± 187.7[a]	100.3 ± 22.4[a]	102.8 ± 39.1[a]	239.5 ± 37.8[ab]	187.4 ± 28.2[a]	4.17 ± 0.79[ab]
3	2204.5 ± 187.7[a]	89.1 ± 22.4[a]	91.3 ± 39.1[a]	212.3 ± 37.8[b]	193.4 ± 28.2[a]	4.49 ± 0.79[ab]
4	2166.5 ± 187.7[a]	68.6 ± 22.4[a]	108.5 ± 39.1[a]	190.3 ± 37.8[b]	214.3 ± 28.2[a]	2.90 ± 0.79[c]
5	2213.0 ± 187.7[a]	84.3 ± 22.4[a]	89.4 ± 39.1[a]	247.3 ± 37.8[ab]	210.6 ± 28.2[a]	3.31 ± 0.79[bc]

Difference superindice, statistical differences (P < 0.05).

Table 6. Averages obtained from the chicken breasts at day 35.

Treat.	W. Breasts (g)	Los.Bre. Thaw. (g)	Bone Tissue (g)	Wat. Loss Cook (%)
1	595.4 ± 40.8 [ab]	6.63 ± 1.58[a]	51.25 ± 3.43[a]	38.88 ± 4.41[ab]
2	669.1 ± 40.8 [b]	6.50 ± 1.58[a]	50.88 ± 3.43[a]	41.38 ± 4.41[a]
3	562.5 ± 40.8 [a]	7.63 ± 1.58[a]	45.75 ± 3.43[ab]	33.38 ± 4.41[ab]
4	550.9 ± 40.8 [a]	7.75 ± 1.58[a]	47.25 ± 3.43[ab]	30.25 ± 4.41[b]
5	558.5 ± 40.8 [a]	7.13 ± 1.58[a]	43.38 ± 3.43[b]	31.38 ± 4.41[b]

Difference superindice, statistical differences (P < 0.05).

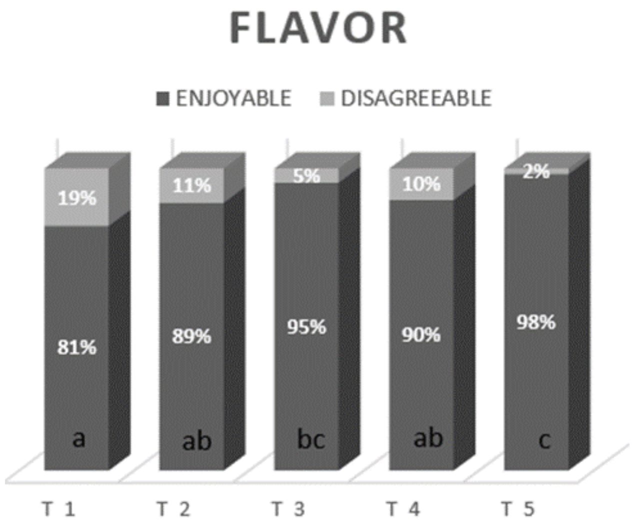

Figure 1. Flavor comparative results.

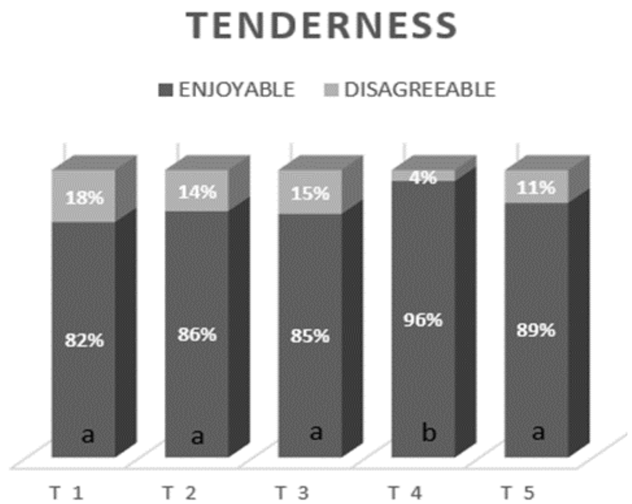

Figure 2. Tenderness comparative results (%).

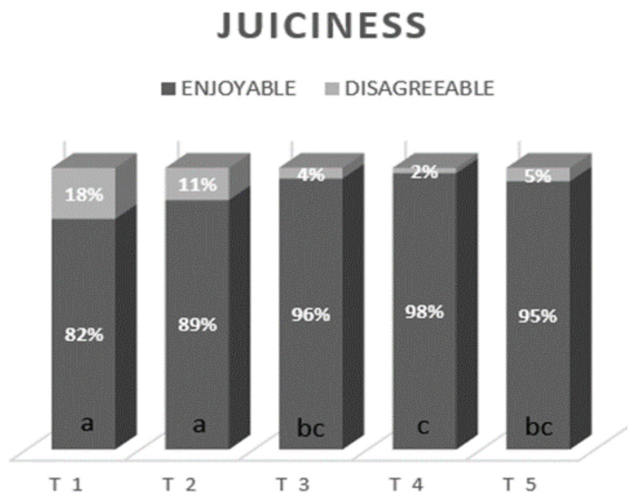

Figure 3. Juiciness comparative results (%).

Conclusions

The administration of 2 ml of infusion of *M. spicata* L. in drinking water showed no effect on the productive parameters up to 30% per liter because a decrease in feed consumption in the slaugther week for T_5 (40% of infusion) was observed indicate a limit of infusion use. The principal effects on infusion *M. spicata* L was on abdominal fat which was lower thickness in T_4 (30%) and T_5 (40%) maybe due to the presence of flavonoids in the mint plant, which have a positive effect on lipid metabolism, resulting in a lean product. Flavor, tenderness and juiciness showed a favorable acceptance for meat of animals recibing the infusion treatements in relation to the control group due to the tendency of the majority of the Ecuador population to consume products with markables organoleptics characteristiques coming from animals raised.

Acknowledgments

To the Animal Scientist Doctor Dervin Bartolo Dean Gutiérrez, PHD and Veterinary Medicine Doctor Carlos Armando Alvarez Díaz for his collaboration in writing and translation into the English language of this work.

References

Ameri, S; Samadi, F; Dastar, B; and Zarehdaran, S. 2016. Efficiency of Peppermint (Mentha piperita) Powder on performance, body temperature and carcass characteristics of broiler chickens in heat stress condition. Iranian Journal of Applied Animal Science 6(4). Retrieved April 24, 2018, from: http://ijas.iaurasht.ac. ir/article_526645_4686eef9f2e841e4d270e5971a70b924.pdf

Babak, D. and Nahashon, S. 2014. A Review on Effects of Aloe Vera as a Feed Additive in Broiler Chicken Diets. Annals of Animal Science 14(3):491-500. Retrieved 16 Apr. 2018, from DOI:10.2478/aoas-2014-0026

Beyene, T. 2016. Veterinary drug residues in food-animal products: its risk factors and potential effects on public health. J. Vet. Sci. Technol. 7(1):285. Retrieved April 15, 2018, from: https://pdfs.semanticscholar.org/a32a/7a542168428bc0e0f89aa680578269aeda5f.pdf

Blasco, A. 2010. Análisis de Datos Experimentales para Proyectos Fin de Carrera. Departamento de Ciencia Animal. Escuela Técnica Superior de Ingeniería Agronómica y del Medio Natural. Universidad Politécnica de Valencia. Ref.: 2010.288. Editorial de la UPV.

Böhm, S. 2015. Risk Factors for Diverticulosis, Diverticulitis, Diverticular Perforation, and Bleeding: A Plea for More Subtle History Taking.

Viszeralmedizin 31:84-94. Retrieved April 15, 2018, from: https://doi.org/10.1159/000381867

Chiriboga Chuchuca, C.; Sánchez Quinche, A.; Vargas González, O.; Hurtado Flores, L. and Quevedo Guerrero, J. 2016. Uso de Infusión de oreganón Plectranthus amboinicus (Lour.) Spreng y del vinagre en la crianza de pollos "Acriollados" (*Gallus gallus* domesticus) mejorados. Acta Agronómica 65(3):298 - 303. Retrieved April 15, 2018, from: DOI: https://doi.org/10.15446/acag.v65n3.46222

Darabighane, B.; Gheshlagh, F.; Navidshad, B.;Mahdavi, A.; Zarei, A. and Nahashon, S. 2017. Effects of Peppermint (Mentha piperita) and Aloe vera (Aloe barbadensis) on Ileum Microflora Population and Growth Performance of Broiler Chickens in Comparison with Antibiotic Growth Promoter. Iranian Journal of Applied Animal Science, *7*(1). Retrieved April 24, 2018, from: http://ijas.iaurasht.ac.ir /article_52 8873_487e4981f88b596a60692e1053775dc7.pdf

Diaz-Sanchez, S.; D'Souza, D.; Biswas, D.; Hanning, I. 2015. Botanical alternatives to antibiotics for use in organic poultry production, Poultry Science 94(6):1419–1430. Retrieved April 15, 2018, from: https://doi.org/10.3382/ps/pev014

González-Cerón, F.; Rekaya, R.; Aggrey, S. 2015. Genetic analysis of bone quality traits and growth in a random mating broiler population, Poultry Science 94(5):883–889. Retrieved April 15, 2018, from: https://doi.org/10.3382/ps/pev056

Khursheed, A.; Banday, M. T.; Khan, A. A.; Adil, S.; Ganai, A. M.; Sheikh, I. U. and Sofi, A. H. 2017. Effect of mint leaves with or without enzyme supplementation on blood biochemistry, carcass characteristics and sensory attributes of broiler chicken. Adv. Anim. Vet. Sci. 5(11):449-455. Retrieved April 25, 2018, from: http://nexusacademicpublishers.com/uploads/files/AAVS_5_11_449-455.pdf

Muhammad Danish Mund; Umair Hassan Khan; Uruj Tahir; Bahar-EMustafa and Asad Fayyaz. 2017. Antimicrobial drug residues in poultry products and implications on public health: A review, International Journal of Food Properties 20(7):1433-1446. Retrieved April 15, 2018, from: DOI: 10.1080/10942912.2016.1212874

Onrust, L.; Ducatelle, R.; Van Driessche, K.; De Maesschalck, C.; Vermeulen, K.; Haesebrouck, F.; Eeckhaut, V. and Van Immerseel, F. 2015. Steering Endogenous Butyrate Production in the Intestinal Tract of Broilers as a Tool to Improve Gut Health. Front. Vet. Sci. Vol. 2, article 75. Retrieved April 15, 2018, from: https://doi.org/10.3389/fvets.2015.00075

Pan, A.; Sun, Q.; Bernstein, A.; Manson, J.; Willett, W.; Hu, F. 2013. Changes in Red Meat Consumption and Subsequent Risk of Type 2 Diabetes MellitusThree Cohorts of US Men and Women. JAMA Intern Med. 173(14):1328–1335. Retrieved April 15, 2018, from: https://jamanetwork.com/journals/jamainternalmedicine/fullarticle/1697785?utm_source=feedly

Reyer, H.; Hawken, R.; Murani, E.; Ponsuksili, S. and Wimmers, K. 2015. The genetics of feed conversion efficiency traits in a commercial broiler line. Scientific Reports. volume 5, Article number: 16387. Retrieved April 15, 2018, from: DOI:10.1038/srep16387

Ricke, S. 2015. Potential of fructooligosaccharide prebiotics in alternative and nonconventional poultry production systems, Poultry Science Volume 94(6):1411–1418. Retrieved April 15, 2018, from: https://doi.org/10.3382/ps/pev049

Samant, S.; Crandall, P.; O'Bryan, C.; Lingbeck, J.;Martin, E.; Seo, H. 2015. Sensory impact of chemical and natural antimicrobials on poultry products: a review, Poultry Science 94(7):1699–1710. Retrieved April 15, 2018, from: https://doi.org/10.3382/ps/pev134

Sánchez, A.; Ávila, S.; Hurtado, L.; Aguilar, L.; Vargas, O.; Zapata, M. 2016. Effect of Cymbopogon Citratus (DC.) Stapf; Plectra Thus Amboinicus (Lour.), *Tilia Cordata* (Mill.), Lippia Alba (Mill.) and *Ocimun Bacilicum* (L.), To Control *Escherichia coli* in Broiler Chickens. American International Journal of Contemporary Research 6(5). Retrieved April 15, 2018, from: http://www.aijcrnet.com/journal/index/1071

Sheng, Z.; Pettersson, M.; Honaker, C.; Siegel, P. and Carlborg, Ö. 2015. Standing genetic variation as a major contributor to adaptation in the Virginia chicken lines selection experiment. Genome Biology 16:219. Retrieved April 15, 2018, from: https://doi.org/10.1186/s13059-015-0785-z

Stratmann, A.; Fröhlich, E.; Gebhardt-Henrich, S.; Harlander-Matauschek, A.; Würbel, H.; Toscano, M. 2016. Genetic selection to increase bone strength affects prevalence of keel bone damage and egg parameters in commercially housed laying hens, Poultry Science 95(5):975–984. Retrieved April 15, 2018, from: https://doi.org/10.3382/ps/pew026

Wie, G.; Cho, Y.; Kang, H.; Ryu, K.; Yoo, M.; Kim, Y.; ... Joung, H. 2014. Red meat consumption is associated with an increased overall cancer risk: A prospective cohort study in Korea. British Journal of Nutrition 112(2):238-247. Retrieved April 15, 2018, from: DOI: 10.1017/S0007114514000683.