

Effects of thyme powder and aqueous extract on fatty acid profile of breast meat in broiler chicks

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Abstract

This experiment was performed to evaluate the effects of thyme (*Thymus vulgaris*) extract and thyme powder on fatty acid profile of breast meat in broilers. Experimental treatments included aqueous extract of thyme (50 and 100 mg/kg feed) and thyme powder (150 and 250 mg/kg feed) which were used in combination with the basal diet (control). The obtained results revealed the highest percentage of unsaturated fatty acids was related to the higher levels of thyme powder and thyme extract; the highest mean was related to thyme extract (100)+thyme powder (250), and the lowest to thyme extract (0)+thyme powder (0). In general, in the present study, it can be concluded that the use of thyme powder and thyme extract in the diet of Ross 308 broilers decreased some saturated fatty acids and increased unsaturated fatty acids which have health benefits.

Key words: *Thymus vulgaris*, chick, breast, meat, fatty acid profile

Introduction

Medicinal plants and their products have attracted attention due to factors such as high economic value and low cost of their production, no destructive effects on the environment (organic drugs), few side effects compared to chemical drugs and antibiotics, and reduced relative resistance to disease agents. In recent years, these sources of medicine have attained a special value and place in the breeding, production and treatment of livestock and poultry (Tipu et al., 2006).

In recent years, increasing consumer demand for healthy products has stimulated the production of meat products by reduc-

ing fat content and/or changing fat profiles. The fat composition of poultry meat may generally be manipulated using selected foods with specific nutritional properties (Sarica, 2003).

Mammals are able to produce saturated and unsaturated fatty acids through simple precursors such as glucose and amino acids (Volker et al, 2001). Beneficial role of unsaturated fatty acids (PUFAs) such as linoleic acid (LA 18:2n-6), linolenic acid (α -LNA 18:3n-3), eicosapentaenoic acid (EPA 20:5n-3) and docosahexaenoic acid (DHA) 22:6n-3) includes the prevention of various human disorders such as breast cancer, severe cardiac arrhyth-

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mias, cardiovascular disease, rheumatoid arthritis, ventricular fibrillation and inflammatory diseases (Rudra et al., 2001).

Some herbs and their products (extracts and essential oils) have natural effects such as tonic, anti-coccidial, anti-fungal, anti-parasitic, anti-flatulence and antioxidant (Tipu et al., 2006).

Hernandez et al. (2004) showed that some plant extracts such as thyme (*Thymus vulgaris*) cause faster growth and improve intestinal digestion, starch digestibility, dry matter utilization of diets and carcass traits in broilers. Thyme extract has very high antioxidant properties that, in addition to reducing blood lipids, can play a role in inhibiting LDL oxidation. Carvacrol reduces plasma triglyceride concentrations. The use of carvacrol has been reported to stimulate the growth and proliferation of lactobacilli; lactobacilli play an important role in improving blood parameters and lowering serum lipids (Esteve-Garcia and Mack, 2000). Feed supplement with thyme essential oil can be considered as a useful natural supplement in the poultry industry to improve meat quality (Luna et al. 2010, Angelovicova et al. 2013). So, the purpose of the experiment was to evaluate the effects of thyme powder and its extract on profile of breast fatty acids in broiler chickens.

Materials and Methods

200 one-day chicks (45 ± 2 g) were used in a total of 5 treatments and four replications and 10 chickens per replication for 42 days. All rearing processes were carried out under standard protocols (Azizi et al. 2020). The treatments were as below:

Treatment 1: TE (0) + TP (0), aqueous extract of thyme (0 mg/kg) + thyme powder (0 mg/kg)

Treatment 2: TE (50) + TP (150), aqueous extract of thyme (50 mg/kg) + thyme powder (150 mg/kg)

Treatment 3: TE (50) + TP (250), aqueous extract of thyme (50 mg/kg) + thyme powder (250 mg/kg)

Treatment 4: TE (100) + TP (150), aqueous extract of thyme (100 mg/kg) + thyme powder (150 mg/kg)

Treatment 5: TE (100) + TP (250), aqueous extract of thyme (100 mg/kg) + thyme powder (250 mg/kg)

The aqueous extract of thyme and thyme powder were made by Zarghani Pharmaceutical Company (Sabzevar, Iran). Diets were adjusted according to the poultry nutritional requirements table containing the minimum nutrients recommended in the Ross 308 strain feeding guide Manual (Table 1).

Determination of breast meat fatty acid profile was performed by extracting 10 g of breast

Table 1 Ingredients, chemical composition, and energy of the used diets (from 1st to 42nd days of age)

Ingredients (g/kg as-fed)	Starter diet (1st-10th days of age)	Grower diet (11st-24th days of age)	Finisher diet (25th-42nd days of age)
Corn	47.03	59.60	65.99
Wheat	5.58	5.00	5.00
Soybean meal (44% Crude protein)	29.02	16.15	10.28
Corn gluten	10.00	11.48	11.50
Soy oil	3.50	3.40	3.09
Limestone	1.45	1.23	1.00
Di-calcium phosphate	1.95	1.80	1.83
Salt	0.20	0.20	0.20
Vitamin and mineral supplements ¹	0.50	0.50	0.50
DL-methionine	0.52	0.58	0.57
L-lysine hydrochloride	0.25	0.06	0.04
Calculated compounds			
Metabolizable energy (kcal/kg)	2950	3000	3050
Crude protein(%)	22	20	19
Lysine(%)	1.3	1.2	1.1
Methionine(%)	0.56	0.54	0.52
Met+Cys(%)	0.92	0.90	0.88
Calcium(%)	1.04	0.95	0.92
Available phosphorus	0.52	0.47	0.41

¹The amount of vitamins and minerals per kg of the final diet: vitamin A, 9000 IU; vitamin D3, 3000 IU; vitamin E, 18 IU; vitamin K3, 3 mg; vitamin B1(Thiamine), 1.8 mg; vitamin B2(Riboflavin), 6 mg; vitamin B6(Pyridoxine), 3 mg; vitamin B12(Cyanocobalamin), 0.012 mg; vitamin B3(Niacin), 30 mg; vitamin B9(Folic acid), 1 mg; vitamin H3(Biotin), 0.24mg; vitamin B5(Pantothenic acid), 10 mg; 500 mg; Choline, 100 mg; Mn, 100 mg; Zinc, 80 mg; Iron, 10 mg; Cu, 1 mg; I, 0.2 mg; Selenium

fat from 1 chicken in each treatment. At first, the fat samples were mixed well with 100 ml of methanol: chloroform (2:1) solution for 3 to 4 hours. The samples were then mixed with 25 ml of sodium chloride saturated solution in a decanter funnel. In the next step, the chloroform phase containing the fat was filtered through a filter paper impregnated with potassium anhydrous sulphate. The filtered sample was dried under vacuum in a rotary evaporator. An aliquot (10 mg) of extracted fat was stirred well with 2 ml of potassium hydroxide, 2 ml of methanol and 7 ml of n-hexane, then the resulting mixture centrifuged for 10 min. The sample was left for 5 min for the layers to separate. About one microliter of the supernatant was injected into the gas chromatograph to obtain the profile of fatty acids. The amount of each fatty acid was expressed as a percentage of total fatty acids (Tavakoli et al., 2020).

The obtained data were statistically analyzed using analysis of variance by SAS statistical software (1982). The mean of treatments was compared at the 5 % probability level with Duncan's multiple range test. The design used in this experiment was completely random.

Results and Discussion

The obtained data about percentage of fatty acids in breast muscle tissue is shown in Table 2. The results showed that the lowest percentage of three saturated fatty acids, myristic acid, palmitic acid and stearic acid were related to the level of thyme extract (100) and thyme powder (150) compared to the control group, and the highest percentage of saturated fatty acids was related to the level of thyme extract (50) and powder (250) compared to the control group, but the highest percentage of unsaturated fatty acids palmitoleic acid and cis-11,14-eicosadienoic acid was related to level thyme extract (50) and thyme powder (250). In addition, the highest percentage of cis-11,14,17-eicosatrienoic acid was related to the highest level of use of thyme powder and thyme extract.

Lee et al. (2003) also found that the amount of linoleic acid in adipose tissue increased with thyme supplementation in the diet, which is consistent with the results of the present experiment. Lee et al. (2003) showed that the level of oleic acid in adipose tissue of broiler chickens decreases

Table 2 Profile of breast fatty acids of Ross 308 broilers fed diets containing different levels of thyme extract and thyme powder

	Myristic Acid Methyl Ester C14:0 (%)	Palmitic Acid Methyl Ester C16:0 (%)	Palmitoleic Acid Methyl Ester C16:1c (%)	Stearic Acid Methyl Ester C18:0 (%)	Oleic Acid Methyl Ester C18:1n9c (%)	Linoleic Acid Methyl Ester C18:2n6c (%)	Linolenic Acid Methyl Ester C18:3n3 (%)	cis-11,14-Eicosadienoic Acid Methyl Ester C20:2c (%)	cis-8,11,14-Eicosatrienoic Acid Methyl Ester C20:3n6c (%)	cis-11,14,17-Eicosatrienoic Acid Methyl Ester C20:3 (%)
Thyme extract (0 mg/kg) -thyme powder (0 mg/kg)	2.02	37.48	3.14	11.40	22.57	17.65	0.50	0.38	0.67	4.18
Thyme extract (50 mg/kg) -thyme powder (150 mg/kg)	1.67	32.31	2.65	11.78	25.74	19.97	0.86	0.56	0.77	3.68
Thyme extract (50 mg/kg) -thyme powder (250 mg/kg)	2.54	39.34	3.56	11.53	21.47	16.98	0.63	0.58	0.68	2.69
Thyme extract (100 mg/kg) -thyme powder (150 mg/kg)	1.33	28.22	2.40	9.09	21.04	18.38	0.77	0.52	0.52	2.73
Thyme extract (100 mg/kg) -thyme powder (250 mg/kg)	1.87	33.73	1.91	14.60	25.00	17.36	0.39	0.38	0.62	4.14

es when fed a diet containing thymol, which does not correspond to the results of the present experiment. Youdim et al. (2000) also found that the content of palmitic and stearic acid in the brain of mice fed with thyme oil was lower than the control group, which is consistent with the results of the present experiment.

Conclusion

In general, in the present study, it can be concluded that the use of thyme powder and thyme extract in the diet of Ross 308 broilers decreased some saturated fatty acids and increased unsatu-

rated fatty acids which have health benefits. Therefore, according to the results of this experiment, it is suggested that a mixture of thyme powder and thyme extract be used in broiler feeding.

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Učinci majčine dušice u prahu i vodenog ekstrakta na profil masnih kiselina u mesu prsiju brojlera

Sažetak

Istraživanje je provedeno kako bi se ocijenio utjecaj ekstrakta timijana (*Thymus vulgaris*) i timijana u prahu na profil masnih kiselina prsnih mišića brojlera. U eksperimentu je korištena vodena otopina timijana (50 i 100 mg/kg hrane) i timijan u prahu (150 i 250 mg/kg hrane), u kombinaciji s osnovnom hranom (kontrolna skupina). Dobiveni rezultati su pokazali da je najveći postotak nezasićenih masnih kiselina povezan s višim razinama timijana u prahu i timijanovog ekstrakta; najviša srednja vrijednost je povezana s ekstraktom timijana (100) + timijanom u prahu (250), a najniža s ekstraktom timijana (0) i timijanom u prahu (0). Općenito, ovo je istraživanje pokazalo da je uporabom timijana u prahu i ekstrakta timijana u hranidbi Ross 308 brojlera smanjen postotak određenih zasićenih masnih kiselina u mesu a povećana je količina nezasićenih masnih kiselina, čija je prisutnost zdravstveno opravdana.

Ključne riječi: *Thymus vulgaris*, pilić, prsa, meso, profil masnih kiselina

Auswirkungen von Thymianpulver und wässrigem Extrakt auf das Fettsäureprofil von Brustfleisch bei Masthähnchen

Zusammenfassung

Dieser Versuch wurde durchgeführt, um die Auswirkungen von Thymian (*Thymus vulgaris*)-Extrakt und Thymian-Pulver auf das Fettsäureprofil des Brustfleisches bei Broilern zu bewerten. Das Experiment umfasste wässrigen Thymianextrakt (50 und 100 mg/kg Futter) und Thymianpulver (150 und 250 mg/kg Futter), die in Kombination mit dem Grundfutter (Kontrolle) verwendet wurden. Die erhaltenen Ergebnisse zeigten, dass der höchste Prozentsatz an ungesättigten Fettsäuren mit höheren Mengen an Thymianpulver und Thymianextrakt zusammenhängt; der höchste Mittelwert wurde mit Thymianextrakt (100) + Thymianpulver (250) und der niedrigste mit Thymianextrakt (0) + Thymianpulver (0) erzielt. Im Allgemeinen kann in der vorliegenden Studie geschlossen werden, dass die Verwendung von Thymianpulver und Thymianextrakt in der Ernährung von Ross 308 Broilern einige gesättigte Fettsäuren verringerte und ungesättigte Fettsäuren erhöhte, was bestimmte gesundheitliche Vorteile hat.

Schlüsselwörter: *Thymus vulgaris*, Küken, Brust, Fleisch, Fettsäureprofil

Los efectos del tomillo en polvo y del extracto acuoso sobre el perfil de los ácidos grasos en la carne de la pechuga de pollo

Resumen

El estudio se realizó para evaluar el efecto del extracto de tomillo (*Thymus vulgaris*) y el polvo de tomillo sobre el perfil de ácidos grasos de los músculos pectorales de los pollos de engorde. En el experimento se utilizó una solución acuosa de tomillo (50 y 100 mg / kg de alimento) y el tomillo en polvo (150

y 250 mg / kg de alimento), en combinación con el alimento básico (el grupo control). Los resultados obtenidos mostraron que el mayor porcentaje de ácidos grasos insaturados se asoció con los mayores niveles del tomillo en polvo y el extracto de tomillo; el valor medio más alto se asocia con el extracto de tomillo (100) + el tomillo en polvo (250), y la más baja con el extracto de tomillo (0) y el tomillo en polvo (0). En general, este estudio demostró que el uso del tomillo en polvo y del extracto de tomillo en la alimentación de los pollos de engorde Ross 308 redujo el porcentaje de ciertos ácidos grasos saturados en la carne y aumentó la cantidad de ácidos grasos insaturados, cuya presencia está médicamente justificada.

Palabras claves: *Thymus vulgaris*, polluelo, pechuga, carne, perfil de ácidos grasos

Effetti del timo in polvere e dell'estratto acquoso del timo sul profilo degli acidi grassi nella carne del petto di pollo

Riassunto

La ricerca è stata condotta per valutare l'impatto dell'estratto di timo (*Thymus vulgaris*) e del timo in polvere sul profilo degli acidi grassi dei muscoli pettorali dei polli da carne. Nell'esperimento sono stati impiegati una soluzione acquosa di timo (50 e 100 mg/kg di mangime) e il timo in polvere (150 e 250 mg/kg di mangime), in combinazione con il mangime base (gruppo di controllo). I risultati ottenuti hanno dimostrato che la maggior percentuale di acidi grassi insaturi è legata ai livelli più elevati di timo in polvere e dell'estratto di timo; il maggior valore medio è legato all'estratto di timo (100) + al timo in polvere (250), quello più basso all'estratto di timo (0) e al timo in polvere (0). In generale, questa ricerca ha dimostrato che, con l'impiego del timo in polvere e dell'estratto di timo nel mangime dei polli da carne Ross 308, si riduce la percentuale di determinati acidi grassi saturi nella carne, mentre aumenta la quantità di acidi grassi insaturi, la cui presenza ha effetti benefici sulla salute.

Parole chiave: *Thymus vulgaris*, pollo, petto, carne, profilo degli acidi grassi