The fatty acid composition of chicken muscles fed with thyme

H. Yetim[1*], O. Sağdıç[1], L. Ekici[1] & H.W. Ockerman[2]

[1]Erciyes Univ., Dept. of Food Eng., Kayseri, Turkey.
[1]The Ohio State Univ., Dept. of Animal Sci., Columbus, OH, USA.
*Email: hyetim@erciyes.edu.tr

Abstract

Consumers have been increasingly demanding foods that provide disease prevention and health enhancing compounds. In this respect, the use of herb and spices as a potential functional compound source in feed of broilers and their possible effects on the properties of their muscle has been considered. Therefore, this preliminary research aimed to investigate the effects of thyme on the fatty acid (FA) composition of chicken muscles. Five homogeneous groups of broilers were fed with Izmir thyme (*Origanum onites*) alone and mixed thymes [Izmir thyme, Karabas thyme (*Thymbra spicata*) and zahter (*Satureja hortensis*) with the ratio of 1:1:1] at the level of 0, 3.5 and 7% in the basic diet for 40 days. Sixteen FA's were separated by a GC, and linoleic acid was the most abundant FA in all samples ranging 36.9-41.0% and 36.0-40.5% in breast and thigh muscles, respectively. The level of oleic acid was 27.3-29.2% and 27.8-30.0% in breast and thigh meat, respectively. The proportion of palmitoleic acid (16:1) was slightly higher in thigh muscle of the chickens fed with thymes whereas stearic acid (18:0) level was lower. The results showed that thyme feeding of broilers lead to only slight alteration on the FA composition of the chicken muscles.

Introduction

The beneficial role of polyunsaturated faty acids (PUFAs) like 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), has been suggested for the prevention of various human disorders like breast cancer, cardiovascular diseases, severe cardiac arrhythmias, ventricular fibrillation, rheumatoid arthritis and inflammatory diseases (Rudra et al., 2001). Mammals are able to synthesize saturated and monounsaturated fatty acids *de novo* from simple precursors such as glucose and amino acids (Volker and Garg, 2001). However, mammals lack the desaturating systems necessary for synthesizing n-3 and n-6 PUFAs, therefore, these essential FAs must be obtained from the diet (Berquin et al., 2008). A high consumption of saturated FAs increases risk for coronary heart disease and the other chronic diseases (Bavelaar and Beynen, 2003). In recent years, the growing demand by consumers for healthier products is stimulating the development of meat products with reduced lipid contents and/or altered lipid profiles. Lipid composition of poultry meat may generally be manipulated by using selected feed materials having particular nutritional characteristics (Sarica, 2003). In fact, several studies have been carried out to observe the effect of the supplementation of feeding with different antioxidants and dietary fat sources on the composition and sensory quality of poultry and the other meat animals (Bonoli et al., 2007; Kralik et al., 2007; Racanicci et al., 2007). In general, it has been demonstrated that feed supplementation with antioxidants is highly effective in protecting raw, processed, cooked, and stored meat from lipid oxidation (Bonoli et al., 2007). Additionally, conjugated dienoic fatty acids with and without hydroxyl group are also isolated from a number of seed oils, and may have some commercial importance that could be transferred to some animal food products. For example, in recent years, there has been a lot of research in an attempt to increase omega-3 polyunsaturated fatty acids of chicken by supplementing different seeds into their diets (Sarica 2003). The objective of this study was to investigate the effects of thyme on the fatty acid (FA) composition of chicken muscles when fed with different types and levels of thyme.

Materials and methods

Animals and diets: In this study, the broilers fed with different thyme and thyme levels (0, 3.5 and 7%) for 40 days were used. In addition to control group, four homogeneous groups of broilers were feed with Izmir thyme (*Origanum onites*) and mixed thyme [Izmir thyme, karabas thyme (*Thymbra spicata*) and zahter (*Satureja hortensis*), mixed 1:1:1]. After the slaughter, the breast and thigh meats were packed and stored at 4°C for 0, 3 and 6 days, and then subjected to the fatty acid profile analyses.

Fatty acid profile: For the analyses, the samples were extracted with ether and stored in eppendorf tubes, then the air was removed and replaced with nitrogen. The samples were stored at -60 ^{o}C until the analysis. A hundred mg of oil was saponified with 100 µL 2N KOH, and 3 mL hexane was added to the mixture. The mixture was vigorously shaken with a vortex for 1 min, and then centrifuged at 5000 rpm for 5

min. FA compositions were analyzed by a GC (Agilent 6890) equipped with a FID and a 100 m x 0.25 mm ID HP-88 column. Injector temperature was 250°C. The oven temperature was kept at 103°C for 1 min, then programmed from 103°C to 170°C at 6.5 °C/min, from 170°C to 215°C for 12 min at 2.75°C/min, finally, 230°C for 5 min. The carrier gas was helium with a flow rate 2 mL/min; split rate was 1/50. FA were identified by comparison of retention times to known standards (Anonymous, 2008). The results were expressed as g fatty acid/100 g total fatty acids (%).

Results and discussion

Changes in fatty acid composition of chicken thigh and breast meat fed with different thyme and thyme levels are shown in Table 1. In this study, saturated, monounsaturated and polyunsaturated form of sixteen FA were separated with no occurrence of unusual FA. Oleic and linoleic acids were the most abundant FA in the all breast and thigh samples analyzed. The values of oleic acid were ranged 27.3-29.2% and 27.8-30.0% in breast and thigh meat, respectively. However, linoleic acid ranged between 36.9-41.0% and 36.0-40.5% in breast and thigh meat of the chicken, respectively.

Table 1. Fatty acid composition of chicken breast and thigh meat fed with thyme diet (%)

Thyme & the % in feed		Storage (days)	C16:0	C16:1	C17:0	C18:0	C18:1n9	C18:2n6	C18:3n6	C20:0	C18:3n3	C20:1n9	C20:2	C22:0	C22:1n9
BREAST															
Control	**0**	**0**	**18.2**	**1.9**	**0.3**	**6.9**	**28.7**	**37.6**	**0.2**	**0.3**	**3.6**	**0.3**	**0.3**	**0.2**	**0.7**
Izmir	3.5	0	18.2	2.2	0.3	6.2	28.4	38.0	0.2	0.3	3.7	0.3	0.3	0.3	0.7
Izmir	7	0	17.3	2.1	0.3	6.5	28.3	39.1	0.1	0.4	3.8	0.2	0.3	0.3	0.8
Mixed	3.5	0	17.4	2.0	0.2	6.1	28.9	39.0	0.2	0.3	3.7	0.3	0.3	0.2	0.6
Mixed	7	0	16.9	1.6	0.2	6.6	28.2	40.5	0.1	0.2	3.8	0.2	0.3	0.2	0.6
Control	**0**	**3**	**17.4**	**1.4**	**0.2**	**7.0**	**27.3**	**40.6**	**0.1**	**0.2**	**3.8**	**0.2**	**0.3**	**0.2**	**0.6**
Izmir	3.5	3	18.0	1.8	0.3	7.2	29.4	37.7	0.1	0.2	3.4	0.2	0.3	0.2	0.6
Izmir	7	3	18.2	1.7	0.3	7.2	28.7	38.3	0.1	0.2	3.3	0.3	0.3	0.2	0.6
Mixed	3.5	3	16.9	1.8	0.2	6.2	28.8	40.2	0.1	0.2	3.7	0.2	0.3	0.2	0.6
Mixed	7	3	18.7	1.8	0.2	7.3	29.2	36.9	0.1	0.2	3.5	0.2	0.3	0.2	0.6
Control	**0**	**6**	**16.6**	**2.0**	**0.2**	**6.1**	**29.0**	**40.0**	**0.1**	**0.2**	**3.7**	**0.2**	**0.3**	**0.2**	**0.6**
Izmir	3.5	6	18.3	2.6	0.2	6.2	29.2	37.7	0.1	0.2	3.6	0.2	0.2	0.2	0.6
Izmir	7	6	18.1	1.9	0.2	6.9	28.2	38.8	0.1	0.2	3.7	0.2	0.3	0.2	0.5
Mixed	3.5	6	17.1	1.6	0.2	6.7	27.5	41.0	0.1	0.3	3.8	0.2	0.2	0.2	0.5
Mixed	7	6	18.4	1.6	0.2	7.3	27.6	38.9	0.1	0.2	3.7	0.2	0.3	0.2	0.7
THIGH															
Control	**0**	**0**	**19.3**	**2.0**	**0.2**	**7.2**	**30.0**	**36.0**	**0.1**	**0.2**	**3.1**	**0.2**	**0.2**	**0.2**	**0.5**
Izmir	3.5	0	19.0	2.2	0.2	6.5	29.5	37.1	0.1	0.2	3.3	0.2	0.2	0.2	0.5
Izmir	7	0	17.0	1.7	0.3	6.5	28.1	40.3	0.1	0.2	3.8	0.2	0.3	0.2	0.7
Mixed	3.5	0	18.5	2.0	0.2	6.9	28.6	38.5	0.1	0.2	3.6	0.2	0.2	0.2	0.2
Mixed	7	0	17.1	2.1	0.2	6.3	28.8	39.6	0.1	0.2	3.7	0.2	0.3	0.2	0.6
Control	**0**	**3**	**17.7**	**1.7**	**0.2**	**6.8**	**28.4**	**39.5**	**0.1**	**0.2**	**3.5**	**0.2**	**0.3**	**0.2**	**0.5**
Izmir	3.5	3	18.1	2.1	0.2	6.6	28.9	38.1	0.1	0.2	3.6	0.2	0.3	0.2	0.6
Izmir	7	3	16.7	1.9	0.2	6.2	28.2	40.5	0.1	0.3	3.9	0.2	0.3	0.2	0.7
Mixed	3.5	3	17.3	1.8	0.2	6.6	27.8	40.2	0.1	0.2	3.7	0.2	0.3	0.2	0.7
Mixed	7	3	17.9	1.8	0.2	6.8	29.2	38.4	0.1	0.2	3.5	0.2	0.2	0.2	0.5
Control	**0**	**6**	**17.1**	**1.8**	**0.2**	**6.4**	**28.7**	**39.7**	**0.1**	**0.2**	**3.7**	**0.2**	**0.3**	**0.2**	**0.6**
Izmir	3.5	6	17.4	1.9	0.2	6.9	29.5	38.2	0.1	0.2	3.7	0.2	0.2	0.2	0.5
Izmir	7	6	17.2	1.8	0.2	6.5	28.2	39.9	0.1	0.2	3.8	0.2	0.3	0.2	0.6
Mixed	3.5	6	17.3	1.8	0.2	6.3	28.5	39.9	0.1	0.3	3.6	0.2	0.3	0.2	0.6
Mixed	7	6	19.0	1.8	0.2	7.2	29.8	36.7	0.1	0.2	3.1	0.2	0.3	0.2	0.5

The average oleic acid of breast and thigh meat were 28.5% and 28.8%, respectively, while linoleic acid were 38.8% and 39.0% in breast and thigh meat, respectively. The proportion of palmitoleic acid (16:1) was slightly higher in thigh muscle of the chickens fed with thymes whereas stearic acid (18:0) level was partially low. Again, the level of α-linolenic acid (C18:3n3) was slightly higher in breast compared to the thigh meat. In this study, the FA analyses showed also that there was a very minor the amount of myristic, myristoleic and pentadecanoic acid in the chicken muscles. However, in general, the results of this research

indicated that thyme feeding of broilers virtually led to no alteration on the FA composition of the chicken muscles.

Conclusions

The consumers are aware that the consumption of animal foods that contains saturated fat and cholesterol raises the blood cholesterol. Under metabolic conditions, substitutions of some fatty acids may regulate the cholesterol. For example, oleic and linoleic acids increase the HDL and lower the LDL. Therefore some researchers around the world have developed a method to nourish chicken and livestock using feed that originated only from aromatic herbs, and the aromatic chicken meat is already produced in small quantities in some countries. In terms of FA composition, chicken lipids are characterized by high levels of unsaturated FA (especially PUFA just like linoleic and linolenic acids) which are considered as beneficial for the human health (Bavelaar and Beynen, 2003; Bonoli et al., 2007). Previous researches showed that full-fat oilseed and fish meal and/or fish oil can enrich chicken meat with α-LNA, EPA, and DHA (Jeun-Hornga et al., 2002; Kralik et al., 2007). However, little information has been published concerning the fatty acid profile of chicken fed with supplemental herb just like thyme in the diets. Our findings showed that the supplementation of thyme in chicken diets had a very limited effect on fatty acid profile. Therefore, in conclusion, it can be stated that flavor rich common herbs in the feed may not necessarily alter the FA composition of the chicken muscles.

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