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PREPARATION OF MEAT TABLETS USING DIFFERENT LEVELS OF OSTRICHES WITH BEEF AND EVALUATION OF FATTY ACID CONTENT IN THE PRODUCT

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Abstract

This study included the use of two types of meat in the preparation of meat tablets, ostrich meat and beef (both from thigh area) and in different proportions, T1 (beef 100%), T2 (beef 75% - ostrich 25%), T3 (Beef 50% - Ostrich 50%), T4 (Beef 25% - Ostrich 75%) and T5 (100% Ostrich). Bread crumb was used as filling at 5%, flavors and table salt were used 2% each. Meat tablets were prepared at weight of 50 g and diameter of 8 cm per tablet. Fat content of fatty acids in meat tablets was analyzed by the aid of GS/MS. The results for T1 and T5 treatments showed the highest percentage of saturated fatty acid (palmitic) which was 14.65 and 16.99%, respectively. While in T2, T3 and T4 the highest percentage of unsaturated fatty acid (oleic) was 21.63, 25.44 and 21.70%, respectively. This study showed that preparing meat tablets (burger) by mixing different ratios from beef and ostrich meat substantially affected fatty acid content in the product.

Key words: ostriches, fatty acid, meat tablets.

Introduction

Fatty acids are the basic units in the composition of oils and fats and are organic compounds composed of a carbon chain of different length, usually the carbon chain in the fatty acid of an even number of carbon atoms. Short-chain fatty acids contain 4-8 carbon atoms. Long chain fatty acids have more than 10 carbon atoms. Fatty acids are also classified according to the presence of double sphincters into saturated fatty acids (Saturated Fatty Acid) and unsaturated fatty acids (Unsaturated Fatty Acid) (Moussawi, 2014). Several studies have been conducted on the content and composition of fatty acids for meat but are still of great interest in research because of their effects on human health. In addition to eating less of total fat, human dietitians recommend eating more polyunsaturated fatty acids (PUFA), especially Fatty acids n-3 at the expense of n-6 fatty acids (Raes *et al*., 2004).

Ostrich meat is relatively rich in polyunsaturated fatty acids (PUFA) compared to conventional meats and therefore has less oxidation stability and is more susceptible to oxidative processes. The oxidative degradation of meat fat negatively affects the nutritional value of meat by converting hydroperoxides to short-chain aldehydes or other oxidizing compounds (Jozwik *et al*., 2015). Poł awska *et al.*, (2016) indicated that the fatty acids found in the muscles of ostrich meat include saturated acids, namely, cystic acid C14:0, palmitic C16:0 and cystic C18:0 in percentages (0.67, 18.53, 11.19), respectively and unsaturated acids Such as palmitic C16:1, oleic C18:1, linoleic C18:2 and linolenic C18:3 in percentages (6.20, 26.40, 15.42, 1.46), respectively. Zdanowska-Sąsiadek *et al.*, (2018), when studying dried snacks made from ostrich meat, beef and chicken, observed that the percentage of saturated fatty acids was (29.9, 40.2, 33.4)% respectively and monounsaturated fatty acids (36.7, 52.2), the percentage of polyunsaturated fatty acids (20.5, 2.61, 25.1), respectively. Horbañczuk and Wierzbicka (2016), when studying the technological characteristics of the quality of ostrich meat, emo and irrigation, showed that the percentage of saturated fatty acids was (39.73, 33.30, 34.44), respectively and monounsaturated fatty acid was (27.27, 41.95, 26.09). The polyunsaturated fatty acids were (32.99, 24.08, 39.09), respectively. Antunes *et al.*, (2017) indicated that fatty acids present in different parts of ostrich carcass

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(leg, groin, heart, viscera, liver), saturated fatty acids (23.2, 27.1, 23.8, 29.5, 37.2), monounsaturated fatty acids (23.4, 26.9, 18.4, 14.4, 21.1) and polyunsaturated fatty acids (40.7, 38.2, 44.8, 45.1, 39.5) respectively.

Forell *et al*., (2010) reported that Berker low-fat beef, which was supported by unsaturated fatty acids and phytocetrol, contained saturated fatty acids (12.66%), while the percentage of monounsaturated fatty acids (80.52)%, while fatty acids. The polyunsaturated ratio was (5.94)%. Selani *et al.*, (2016) in his study of fatty acid content in beef berker with addition of 20% fat showed that the percentage of saturated fatty acids was (32.66%) and the proportion of mono fatty acids was (46.20)%, while the proportion of multiple fatty acids (13.81)%. Bilek and Turhan, (2009) reported fatty acids in beef pies by adding fat (10.20)%, saturated fatty acids (51.88 and 51.86)% respectively and monounsaturated fatty acids (34.99%). Polyunsaturated fatty acids were (2.57 and 2.26)%, respectively.

Materials and Methods

Two types of meat were used in the preparation of meat discs (Burger) thigh meat of ostriches and beef. The meat was cut into small cubes taking into account the removal of fat deposited between the muscles and the binding fibers. Chopped meats were stored in a freezer at -20°C in polyethylene bags until use (Asadi, 2015). Bread crumb powder was used as filler by 5% mixed with 2% spices and 2% salt (Al-Zahir, 1999).

Burger preparation

Ostrich meat and beef were chopped separately using an electric chopping machine. The first chopping was done using a disc with a diameter of 0.8 (cm) and the second chopping was using a disc with a diameter of 4 (mm). Then, the ingredients of the meat (birker) tablets of minced meat, Samun powder, flavorings and salt were mixed by hand in order to obtain a homogeneous mixture. Then the meatballs were formed by a metal mold with a diameter of 8 cm and an approximate weight of 50 g each burger. Treatments were based on the ratio of beef to ostrich meat per one burger where 100% beef burger (T1) (control sample), 75% beef burger and 25% ostrich burger (T2), 50% beef burger, 50% ostrich burger, 50% (T3), 25% beef burger and 75% ostrich burger (T4) and 100% Ostrich Burger (T5).

Fatty acids

Total fatty acids (TFA) in fat derived from burgers for different treatments were estimated using GC/MS gas chromatography in the laboratory of Food Science Department, College of Agriculture-University of Basra, with working specifications as follows: The column furnace temperature is 100°C and the ion source temperature is 200°C while the injection temperature was 250°C, Surface temperature 230°C. Type of dividing injection Control the flow of pressure 89.7 kpa with Total flow 79.7 ml/min.

The flow of column 1.2 ml/min Linear speed of 40.7 cm/sec and target read speed 0.6 sec with scan speed of 100. Distribution ratio was 60 and solvent stop time 3 min., start time 4 min and ending time 29.83 min. The esterification process was applied by placing 0.5 ml of the extracted fat in a closed glass test tube, adding 2 ml of pure methanol (99.99%), mixing the mixture in a vortex and adding 0.5 ml of concentrated sulfuric acid in the form of drops, preheat the mixture by (heated carburetor) to the boiling point (2) minutes to become a clear solution, and then cool to room temperature. 2 ml of hexane and 2 ml of distilled water were added and the glass tube was then closed. The mixture was separated in layers by a vortex apparatus to allow separation of the top layer of 20% methyl ester of fatty acids in hexane. This layer was then precisely injected into the gas chromatograph without prior concentration.

Calculations: Separated fatty acids in the form of peaks were diagnosed and compared with standard fatty acids separated under the same conditions and based on retention time, retention, or holding time.

Results and Discussion

The results in table 1-3 indicated that T1 contained saturated fatty acids (C14:0, C16:0, C17:0, C18:0) in percentages (0.65, 14.65, 0.44, 8.56), respectively. The percentages of unsaturated fatty acids (C16:1, C18:1, C18:2) were (2.1, 14.48, 4.54), respectively. These results are consistent with the results of Forell *et al.*, (2010) when studying the fatty acid content in berker low fat beef and fortified with unsaturated fatty acids in the percentage of fatty acids (Mysteric, Linoleic) and fatty acids (palmitic, palmitolic, stearic). The fatty acid (Oleic acid) was lower than the present study, whereas the burgers he attended were supported by unsaturated fatty acids (Oleic) and did not refer to the fatty acid (margaric).

As for Selani *et al.*, (2016), fatty acid content in beef burger added 20% fat was contrary to the results of the current study. It was found that the percentage of fatty acids (mastic, palmitic, oleic, linoleic) was higher than the results of the present study, while the percentage of fatty acid (palmitolic) less than the results of the current study, the proportion of fatty acid (stearic) has agreed with the result of the current study in his study he did not report any results about fatty acid (margaric).

Table 1: T1 treatment (burgers prepared with 100% beef) content of fatty acids estimated by GC/MS.

Fame IUPAC Name	Common Name	No. of Carbons	R. T.	Area %
Tetradecanoate	Myristic acid	C14:0	13.408	0.65
Hexadecanoic acid	Palmitic acid	C 16:0	17.61	14.65
Heptadecanoic acid	Margaric acid	C17:0	19.599	0.44
Octadecadienoic acid	Stearic acid	C18:0	21.518	8.56
9-Hexadecenoic acid	Palmitoleate acid	C16:1	17.139	2.1
9-Octadecedienoic acid	Oleic acid	C18:1	20.979	14.48
9,12-Octadecadienoic acid	Linoleic acid	C18:2	20.838	4.54

Our results differed from that of Bilek and Turhan (2009) in the study of fatty acid content in beef pancakes by adding (10.20%) fat. The percentage of fatty acids (mastic, palmitic, margaric, stearic and oleic) was higher than the results of the present study while the percentage of fatty acid (palmitolic) was comparable to the results of the present study. The percentage of fatty acid (linoleic) was lower than that in the current study.

Relative to T2 treatments results (Table 2), the saturated fatty acids (C14:0, C16:0, C17:0, C18:0) were present at 0.92, 18.6, 0.2 and 13.6%, respectively, while the unsaturated fatty acids (C16:1, C18:1 and C18:2) were 3.34, 21.63 and 6.85%, respectively. These results are consistent with the findings of Forell *et al.*, (2010) when studying the fatty acid content in the low-fat beef burger supported by polyunsaturated fatty acids in the ratio of fatty acid (linolenic) less than the ratios of current study. While fatty acid (oleic) was several times higher than the proportions of the current study. The fact that the burger was supported by unsaturated fatty acids (oleic). In his study he did not refer to fatty acid (margaric).

As for the Selani *et al.*, (2016) fatty acid content in beef burger with the addition of 20% fat, it was contrary to the results of the present study, as it was found that the percentage of fatty acids (mastic, palmitic, oleic, linoleic) was higher than the results. In our study, the percentage of fatty acids (stearic, palmitolytic) was lower, while no results were reported in the study of fatty acid (margaric).

Our results also differed with that of Bilek and Turhan (2009) in the study of fatty acid content in beef pies by adding fat (10.20)%. The percentage of fatty acids (mastic, palmitic, margaric, stearic, oleic) was higher compared to the results of our study while the percentage of fatty acids (palmitolic, linoleic) was lower.

The results of the fatty acid content in the second treatment were almost identical to those of Horbañczuk and Wierzbicka, (2016) with respect to oleic acid. The ratio of linolenic acid was twice as high as the result of our study. Fatty acids (palmitolytic, margaric) did not mention Horbañczuk and Wierzbicka, (2016) and Antunes *et al.*, (2017). Fatty acids (oleic, palmitic), according to Antunes *et al.,* (2017), were lower in comparison to the results of the current study, while the first did not report any results on citric acid.

Table 2: T2 treatment (burgers prepared with 75% beef and 25% ostrich meat) content of fatty acids estimated by GC/MS.

Fame IUPAC Name	Common Name	No. of Carbons	R. T.	Area %
Tetradecanoate	Myristic acid	C14:0	13.403	0.92
Hexadecanoic acid	Palmitic acid	C 16:0	17.61	18.6
Heptadecanoic acid	Margaric acid	C17:0	19.01	0.2
Octadecadienoic acid	Stearic acid	C18:0	21.512	13.6
9-Hexadecenoic acid	Palmitoleate acid	C16:1	17.138	3.34
9-Octadecedienoic acid	Oleic acid	C18:1	20.976	21.63
9,12-Octadecadienoic acid	Linoleic acid	C18:2	20.838	6.85

Table 3: T3 treatment (burgers prepared with 50% beef and 50% ostrich meat) content of fatty acids estimated by GC/MS.

Fame IUPAC Name	Common Name	No. of Carbons	R. T.	Area %
Tetradecanoate	Myristic acid	C14:0	13.401	0.72
Hexadecanoic acid	Palmitic acid	C 16:0	17.585	6.54
Octadecadienoic acid	Stearic acid	C18:0	21.515	14
9-Hexadecenoic acid	Palmitoleate acid	C16:1	17.138	6.9
9-Octadecedienoic acid	Oleic acid	C18:1	20.978	25.44
9,12-Octadecadienoic acid	Linoleic acid	C18:2	20.836	8.93

The results of table 3, indicated the presence of saturated fatty acids (C14:0, C16:0, C18:0) at (0.72, 6.54, 14)%, respectively, while the percentages of unsaturated fatty acids (C16:1, C18:1) (C18:2) are (6.9, 25.44, 8.93)%, respectively. Horbañczuk and Wierzbicka (2016) and Antunes *et al.*, (2017) did not report any percentages of martic acid, which in this study was 0.72%. The results of this study are contrary to the results of Horbañczuk and Wierzbicka, (2016), which indicated the high levels of fatty acids (linolenic, palmitic) while the percentage of oleic acid was lower than the current study. Our results were also contrary to Antunes *et al.*, (2017) in terms of lower fatty acids (linolenic, palmitic) and higher oleic acid.

These results are consistent with the findings of Forell *et al.*, (2010) when studying the fatty acid content of the low-fat beef berker supported by unsaturated fatty acids in the proportion of fatty acids (marstic, palmitic). It did not agree in

Table 4: T4 treatment (burgers prepared with 25% beef and 75% ostrich meat) content of fatty acids estimated by GC/MS.

Fame IUPAC Name	Common Name	No. of Carbons	R. T.	Area %
Tetradecanoate	Myristic acid	C14:0	13.405	1.04
Hexadecanoic acid	Palmitic acid	C 16:0	17.610	19.21
Octadecadienoic acid	Stearic acid	C18:0	21.516	10.73
9-Hexadecenoic acid	Palmitoleate acid	C16:1	17.140	4.52
9-Octadecedienoic acid	Oleic acid	C18:1	20.981	21.70
9,12-Octadecadienoic acid	Linoleic acid	C18:2	20.842	6.31

the case of (Palmitolik, Stiarik, Linoleic), which was less than the rates of the current study. Oleik was several times higher than the current study. Because the burgers were fortified with unsaturated fatty acids (oleic).

As for the Selani *et al.*, (2016) fatty acid content in beef berker added 20% fat was contrary to the results of the current study, it was found that the proportion of fatty acids (Almstik, palmitic, oleic, linoleic) was higher than the results. The present study had a lower percentage of fatty acids (palmitolytic, stearic).

Our results with Bilek and Turhan (2009) differed in fatty acid content in beef pies by adding (10.20)% fat. The percentage of fatty acids (marstic, palmitic, stearic and oleic) was higher than the results of the present study. While the percentage of fatty acids (palmitolic, linoleic) was lower.

As for T4 treatment (burgers prepared with 25% beef and 75% ostrich meat) results (Table 4), saturated fatty acids (C14:0, C16:0, C18:0) were found (1.04, 19.21, 10.73), respectively. The percentages of unsaturated fatty acids (C16:1, C18:1 and C18:2) were (4.52, 21.70, 6.31), respectively. These results were similar to those of Horbañczuk and Wierzbicka, (2016) only in the case of oleic acid and in the case of fatty acids (palmitic, stearic, linoleic) which were lower in the present study while the rate of palmitolic acid was higher. The results of the study differed with Antunes *et al.*, (2017) in terms of ratios as the levels of oleic and palmitic acids were higher than the latter study, while linoleic was significantly lower than indicated by Antunes *et al.*, (2017). Stiaric did not mention him in the study of the latter. These results are consistent with the findings of Forell *et al.*, (2010) when studying the fatty acid content of the low-fat beef burger supported by polyunsaturated fatty acids in the ratio of fatty acid (linoleic). Fatty acids (mastic, palmitic, palmitolytic and stearic) were lower than the present study. Fatty acid (oleic) was several times higher than the current study in burgers supported by unsaturated fatty acids (oleic).

Our results contradicted the Selani *et al.*, (2016) study on fatty acid content in beef burger with 20% fat added. The percentage of fatty acids (palmitic, oleic, linoleic) was higher than the results of the present study while the percentage of fatty acids (palmitolic, stearic) was lower. The percentage of fatty acid (Marstic) has agreed with the result of our current study. Our results also did not agree with Bilek and Turhan, (2009) in fatty acid ratios in beef pies by adding fat (10.20)%. Fatty acids (mastic, palmitic, stearic and oleic) were higher than the results of the present study. While the percentage of fatty acids (palmitolic, linoleic) was lower.

In case of T5 treatment (100% ostrich meat burger) results (Table 5), saturated fatty acids (C14:0, C16:0, C18:0) were found at rate of 0.43, 16.99 and 16.26%, while percentages of unsaturated fatty acids C16:1, C18:1 and C18:2 were 5.37, 14.24 and 4.02%, respectively. These results differed from to those of Horbañczuk and Wierzbicka, (2016) where palmitic, oleic and linoleic higher than our findings while fatty acids stearic and palmitolic were lower. The results of this study also differed from Antunes *et al.*, (2017) in terms of ratios of oleic and palmitic and palmitolic acids which were higher than those in our study while linoleic was significantly lower than our findings.

Finally, we can concluded that the preparation of burger mixing with different proportions of ostrich meat and beef had a low content of saturated fatty acids and a high content of unsaturated fatty acids. The research encourages the expansion of the use of ostrich meat in the preparation of burgers in order to reduce the proportion of saturated fatty acids and raise the proportion of unsaturated fatty acids, especially for people with high levels of fat and cholesterol in the blood and obesity and atherosclerosis. Further studies on the introduction of ostrich meat into food industries where meat is the main source may be important.

Table 5: T5 treatment (100% ostrich meat burger) content of fatty acids estimated by GC/MS.

Fame IUPAC Name	Common Name	No. of Carbons	R. T.	Area %
Decanoic acid	Capric acid	C10:0	5.047	0.15
Tetradecanoate	Myristic acid	C14:0	13.402	0.43
Hexadecanoic acid	Palmitic acid	C 16:0	17.607	16.99
Octadecadienoic acid	Stearic acid	C18:0	21.514	15.26
9-Hexadecenoic acid	Palmitoleate acid	C16:1	17.136	5.37
9-Octadecedienoic acid	Oleic acid	C18:1	20.977	14.24
9,12-Octadecadienoic acid	Linoleic acid	C18:2	20.837	4.02

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