



## STUDIES ON CHEMICAL COMPOSITION AND QUALITY INDICES OF BEEF KOFTA AND SAUSAGE

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### ABSTRACT

A total of 50 random samples of beef meat products (koftha and sausage) were collected from different supermarkets located in El- Menufia governorate, (25 of each). The samples were taken as intact units and transferred immediately in an ice box to the laboratory in order to investigate their chemical criteria. The obtained results indicated that the mean values of moisture content (%) in the examined samples of beef koftha and beef sausage were  $62.55 \pm 0.13$  and  $62.98 \pm 0.19$ , respectively. The mean values of protein contents (%) in the examined beef koftha and beef sausage samples were  $10.45 \pm 0.15$  and  $10.37 \pm 0.20$  and the misbranded samples were 20 % and 28%, respectively. The mean values of fat contents (%) in the examined beef koftha and beef sausage samples were  $24.17 \pm 0.24$  and  $24.61 \pm 0.26$ , respectively. Therefore, the percentages of the misbranded samples of such meat products were 24 and 36, respectively. The mean values of ash content (%) in the examined beef koftha and beef sausage samples were  $4.14 \pm 0.09$  and  $3.08 \pm 0.07$ , respectively. Application of the keeping quality tests declared that the average values of pH, TVN (mg %) and TBA (mg %) in the examined samples of meat products were  $6.04 \pm 0.01$ ,  $10.09 \pm 0.30$  &  $0.14 \pm 0.01$  for beef koftha and  $6.21 \pm 0.04$ ,  $13.37 \pm 0.41$  &  $0.18 \pm 0.01$  for beef sausage, respectively. Concerning the essential amino acids in beef koftha had the highest content of alanine (7.11), cysteine (5.70), glycine (8.18), leucine (13.06), proline (8.22) and thyronine (7.41). Also, beef sausage had the highest content of methionine (9.05), phenylalanine (6.81) and serine (7.93). Regarding the essential fatty acid of examined koftha and sausage, the total unsaturated fatty acids were 43.6% and 42.7%, however, the total saturated fatty acids were 57.3% and 60.1% and the ratio between them were 0.74% and 0.66%, respectively.

**KEY WORDS:** Chemical composition, Koftha, quality indices, Sausage.

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### 1. INTRODUCTION

The modern technology in different fields gives chance for the meat processors to produce new products in different shapes, easily handled, stored and rapidly used. The need for meat products have many tasks includes new flavor, preservation and of low calories. The quality of raw material as well as the additives used in the final products is very important for public health. Therefore, the use of low quality ingredients in the processing yields low quality meat products [17]. Ash content is influenced by type of meat used, spices as well as

binder and filler used [7]. Technological developments in meat processing, preservation and handling have give consumers a much greater choice over the foods they can buy. Consequently, consumers have become more selective and more considered about the quality of the product, which became a more significant factor in marketing meat products [8].

Amino acid composition of meat products can play a significant role in meat identification; the ratios of amino acids arginine, histidine and lysine for the

investigated species of animals have been obtained. These ratios do not depend on age or weight of the animal [10]. The chemical and nutritional composition of each meat product is greatly varied from one product to another as it contains different kinds of tissues and sometimes a mixture of meat of various organs [13]. It is of great importance to mention that, amino acids and fatty acids fractionations can successfully be used for detection of meat adulteration by other animal tissues [1]. Therefore, the chemical analysis is applied to ensure compliance with legal and compositional standards of some meat products including luncheon and beef burger as follows: *Nutritional criteria:* determination of moisture, protein, fat and ash contents. *Keeping quality indices:* Determination of Hydrogen ion concentration (PH), Total Volatile Basic Nitrogen (TVB-N) and Thiobarbituric Acid number (TBA). Finally, amino acids and Fatty acids fractionations

## 2. MATERIALS AND METHODS

### 2.1. Collection of samples:

A total of 50 random samples of some meat products represented by beef kofta and beef sausage (25 of each) were collected from different supermarkets in Menoufia governorate. All collected samples were aseptically transferred in an insulated ice box to the laboratory without undue delay to determine their chemical profiles. Accordingly, the collected samples of meat products were subjected to the following examinations:

### 2.2. Nutritional criteria:

2.2.1. Determination of moisture content: according to AOAC [4].

2.2.2. Estimation of protein content: according to AOAC [4].

2.2.3. Estimation of fat content: according to AOAC [4].

2.2.4. Estimation of ash content according to AOAC [4].

### 2.3. Keeping quality indices:

2.3.1. Determination of pH according to Pearson [19].

2.3.2. Determination of Total Volatile Nitrogen (TVN), according to FAO [9]

2.3.3. Determination of Thiobarbituric acid number (TBA) according to Vyncke [24]

### 2.4. Amino acid profile:

The technique recommended by Mabbott [15] for fractionation of amino acids was applied by Gas Liquid Chromatography (GLC).

### 2.5. Fatty acid profile:

Fatty acid profile was determined according to AOAC [4].

2.5.1. Extraction of fat from meat according to Aura *et al.* [5]

2.5.2. Methylation of fatty acid according to AOCS [3]

2.5.3. Separation of fatty acid methyles according to Vogel [23]

## 3. RESULTS AND DISCUSSION

Meat products are highly demanded due to high biological value, reasonable price, and agreeable taste and easy during serving. Meat products are considered as excellent source of high quality protein, minerals and vitamins [13].

### 3.1. Nutritional criteria:

#### 3.1.1. Moisture:

Results achieved in table (1) revealed that the moisture % in the examined meat product samples was  $62.55 \pm 0.13$  for beef kofta and  $62.98 \pm 0.19$  for beef sausage.

The variation in the moisture content of the examined samples is influenced by the variable amount of lean meat added [14] or may be attributed to the use of sodium chloride or addition of water which added to facilitate the chopping of meat and the mixing of the ingredients. Water or ice added to the meat mass provides considerable functional qualities through chills the meat during the chopping or mixing operations to prevent over heating.

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This is accomplished by lowering the initial temperatures and by lubricating the meat mass to impart fluidity to the emulsion. Added water aids in dissolving sodium chloride and curing salts to give better distribution in the mass, or meat mixture that aids in proper filling of the casings; Texture and tenderness of the finished sausages are markedly affected by the added water content [18].

### 3.1.2. Protein content:

Regarding the results recorded in table (1) it is evident that, the mean value of protein % in the examined beef kofta was  $10.45 \pm 0.15\%$ , the labeled limit was  $<10\%$  and the misbranded samples were 20%, while for beef sausage it was  $10.37 \pm 0.20\%$ , the labeled limit was  $<10\%$  and the misbranded samples were 28%. Meat protein is of high biological value, it supplies the human-beings body by all essential and non-essential amino acids [20]. Therefore, the shortage in the protein content of some meat products may be attributed to the use of improper meat cuts and/or the use of meat trimmings in preparation or substitution with non meat components, since meat proteins are relatively more expensive than non meat components [13].

### 3.1.3. Fat content

Table (1) indicated that the mean value of fat content in the examined samples was  $24.17 \pm 0.24\%$ , the labeled limit was  $< 25\%$  and the misbranded samples were 24% for beef kofta. While mean for beef sausage, the fat content was  $24.61 \pm 0.26\%$ , the labeled limit was  $<25\%$  and the

misbranded samples were 36%. The variations in the fat content of meat products may be attributed to the differences in meat cuts as brisket meat is of high fat content (35-40%) and fatty portions used or due to using of improper formulation such products or the addition of foreign fat which are the main cause of much fat in the final product [16].

### 3.1.4. Ash content

Regarding the results recorded in table (1) the mean ash % in the examined meat product sample was  $4.14 \pm 0.09\%$  for beef kofta and  $3.80 \pm 0.07\%$  for beef sausage. The ash content in meat products not only depend on muscle minerals but also on the curing salt added [12].

## 3.2. Keeping quality indices

### 3.2.1. Hydrogen ion concentration (pH value)

Results given in Table (2) declared that the mean pH value was  $6.04 \pm 0.01$  for beef kofta and  $6.21 \pm 0.04$  for beef sausage. In this respect, the pH value of meat and meat products under any condition shouldn't exceed 6.4, otherwise it must be considered as unfit for human consumption [22]. So, the ideal pH for meat is between 5.8 and 6.3 [17].

### 3.2.2. Total Volatile Nitrogen:

The data recorded in table (2) indicated that the mean value of TVN was  $10.09 \pm 0.30$  mg% for beef kofta and  $13.37 \pm 0.41$  mg% for beef sausage. Generally, the product quality of processed meat is directly attributed to the quality of raw materials. Meat for further processing

Table1 Statistical analytical results of the nutritional criteria of the examined meat product samples (n=25).

Meat Products	Moisture Mean± S.E*	Ash Mean± S.E*	Mean value of Protein *	Protein Misbranded samples		Mean value of Fat	Fat Misbranded samples	
				No.	%		No.	%
Kofta	$62.55 \pm 0.13$	$4.14 \pm 0.09$	$10.45 \pm 0.15$	5	20	$24.17 \pm 0.24$	6	24
Sausage	$62.98 \pm 0.19$	$3.08 \pm 0.07$	$10.37 \pm 0.20$	7	28	$24.61 \pm 0.26$	9	36

\*Labeled protein limit  $< 10\%$  ,\* Labeled fat limit  $< 25\%$ .

has already been frozen, amplifying the effects of further freezing, storage and thawing. Additional ingredients are usually added which affect the quality, shelf-life and over all acceptability of these products and the physicochemical reactions occurring during the freezing process [6].

### 3.2.3. Thiobarbituric Acid number:

The recorded data in table (2) showed that mean TBA values (mg %) was  $0.14 \pm 0.01$  for beef kofta and  $0.18 \pm 1.01$  for beef sausage. It is of great importance to mention that TBA values may be considered as a useful quality index for the assessment of rancidity during the storage of food rich in fat content. Also, TBA test is a sensitive test for the spoiled products of highly unsaturated fatty acids which do not appear clear in determination [11].

### 3.2.4. Amino acid profile

Table (3) revealed that the amino acid profile in the examined samples of meat products showed that, there are marked differences between the examined samples in the amino acid composition. Beef kofta had the highest content of alanine (7.11%), cysteine (5.70%), glycine (8.18%), leucine (13.06%), proline (8.22%) and threonine (7.41%), moreover, beef sausage had the highest content of methionine (9.05%), phenylalanine (6.81 %) and serine (7.93%).

The differences in the amino acid contents may be attributed to the use of different meat cuts and the use of muscles rich in collagen in the formulation as hydroxyproline amino acid which is the major component of the collagen protein.

The amino acid profile is an important parameter because some amino acids cannot be synthesized by human and must be obtained from diet. Meat is rich in so-called essential amino acids as lysine, leucine, isoleucine, and sulfur-containing amino acids which considered as a high quality protein. Generally, 95-100% of protein from meat and meat products are highly digestible [2].

### 3.2.5. Fatty acid profile

It is obvious from the results given in table (3) that the fatty acid contents (%) in the examined samples of kofta were 3.3 for C8:0, 3.8 for C10:0, 2.9 for C12:0, 6.5 for C14:0 and 25.8 for C16:0, 10.3 for C18:0, 13.4 for C18:1, 1.9 for C18:2, 4.7 for C20:0, 3.8 for C20:1, 1.2 for C20:4, 4.5 for C22:1, 3.3 for C22:5 and 15.6 for C22:6. Thus, total unsaturated fatty acids were 42.7%, while the total saturated fatty acids were 57.3% and the ratio between them was 0.74, Regarding the examined samples of beef sausage, the total unsaturated fatty acids were 39.9% however, the total saturated fatty acids were 60.1% and the ratio between them were 0.66, respectively. The use of fatty acids contents for differentiation of meat kinds in meat products was previously applied by Sawsan [21] who found the differences appeared clearly in the total saturated fatty acids (TS) and total unsaturated fatty acids (TU) values. Also, TU and TS fatty acids of cattle meat were 43.9% and 35.3%, respectively. Moreover, TU/TS value was 0.78% in cattle meat.

Table 2 Statistical analytical results of keeping quality indices of the examined meat product samples. (n=25).

Meat Products	pH	TVBN	TBA
	Mean $\pm$ S.E*	Mean $\pm$ S.E*	Mean $\pm$ S.E*
Beef Kofta	$6.04 \pm 0.01$	$10.09 \pm 0.30$	$0.14 \pm 0.01$
Beef Sausage	$6.21 \pm 0.04$	$13.37 \pm 0.41$	$0.18 \pm 0.01$

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Table 3 Average of amino acids and fatty acids fractionation in the examined meat product samples.

Amino acids	Meat products		Fatty acids	Meat products	
	Kofta	Sausage		Kofta	Sausage
Alanine	7.11	4.62	C 8:0	3.3	4.6
Arginine	3.92	5.58	C 10:0	3.8	5.0
Aspartic acid	6.08	2.47	C 12:0	2.9	2.4
Cystein	5.70	1.91	C 14:0	6.5	5.9
Glutamic acid	10.27	11.83	C 16:0	25.8	28.1
Glycine	8.18	5.36	C 18:0	10.3	7.6
Hydroxyproline	1.93	2.29	C 18:1	13.4	9.0
Leucine	13.06	10.42	C 18:2	1.9	2.2
Lysine	1.85	3.57	C 20:0	4.7	6.5
Methionine	7.12	9.05	C 20:1	3.8	3.1
Phenylalanine	4.30	6.18	C 20:4	1.2	0.6
Proline	8.22	2.66	C 22:1	4.5	5.3
Serine	3.78	7.93	C 22:5	3.3	2.8
Thyronine	7.41	1.84	C 22:6	15.6	16.9
Tryptophan	0.92	1.23	TU	42.7	39.9
Tyrosine	5.36	3.75	TS	57.3	60.1
Valine	2.72	8.51	TU / TS	0.74	0.66

TU: Total unsaturated fatty acid, TS: Total saturated fatty acid

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## دراسات عن المحتوى الكيميائي ودلائل الجودة في الكفتة والسجق

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### الملخص العربي

يعتبر لحم الأبقار مصدر جيد للبروتين الحيواني عالي القيمة الغذائية، كما أنه يحتوي علي نسبة من الدهن ذو الجودة العالية. لذلك فقد تم دراسة الخصائص الكيميائية لمنتجات لحوم الأبقار لما لها من أهمية علي المستوي الغذائي للإنسان ولقد تم فحص 50 عينة من منتجات لحوم الأبقار ممثلة في الكفتة والسجق بواقع 25 عينة لكل منها وقد تم قياس نسبة البروتين، قياس نسبة الدهن، قياس نسبة الرطوبة، قياس نسبة الرماد، قياس نسبة تركيز أيون الهيدروجين، قياس نسبة تركيز النيتروجين القلوي المتصاعد و قياس نسبة حمض الثيوباريتيورك. وقد وجد أن نسبة البروتين والدهن و الرطوبة والرماد في الكفتة كانت كالتالي 10.45 و 24.17 و 62.55 و 4.14 والسجق 10.37 و 24.61 و 62.98 و 3. على التوالي. وبالنسبة للخصائص الكيميائية لمنتجات لحوم الأبقار كانت نسبة تركيز أيون الهيدروجين والنيتروجين القلوي المتصاعد وحمض الثيوباريتيورك في الكفتة 6.04 و 10.09 و 0.14 وفي السجق 6.21 و 13.37 و 0.18 على التوالي. وبدراسة كمية ونوع الأحماض الأمينية الموجودة بها وكذلك دراسة كمية ونوع الأحماض الدهنية الموجودة بها فقد لوحظ أن الكفتة تتمثل بالأنين (117)، وأرجنين (3.92) وأسبارتيك أسيد (6.08) وسيسيتين (5.70) وجلوتاميك أسيد (10.27) وجليسين (8.18) و هيدروكسي برولين (1.93) و ليوسين (13.06) و ليسين (1.85) و ميثايونين (7.12) وفينيل ألانين (4.30) و برولين (8.22) وسيرين (3.78) و ثيرونين (7.41) و تريبتوفان (0.92) و تيروسين (5.36) وفالين (2.72) والسجق ألانين (4.62) وأرجنين (5.58) وأسبارتيك أسيد (2.47) وسيسيتين (1.91) و جلوتاميك أسيد (11.83) وجليسين (5.36) و هيدروكسي برولين (2.29) و ليوسين (10.42) و ليسين (3.57) و ميثايونين (9.05) وفينيل ألانين (6.18) و برولين (2.66) وسيرين (7.93) و ثيرونين (1.84) و تريبتوفان (1.23) و تيروسين (3.75) وفالين (8.51) بالنسبة للأحماض الدهنية توجد أن هناك نسب مختلفة من الأحماض الدهنية وتتفاوت هذه النسب على حسب نوع كل منتج. بالنسبة للأحماض الدهنية الغير مشبعة في الكفتة والسجق 42.7% و 39.9% في حين كانت نسب الأحماض الدهنية المشبعة 57.3% و 60.1% وكانت النسبة الأحماض الدهنية الغير مشبعة الى الاحماض الدهنية المشبعة هي 0.77% و 0.66% على التوالي. هذا وقد تم مناقشة الأهمية الصحية للمحتوى الكيميائي ودلائل الجودة في الكفتة والسجق وتأثيرها على صحة المستهلك.

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