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EVALUATION OF HYGIENIC AND NUTRITIONAL QUALITY OF KOFTA AND SAUSAGE SANDWICHES IN NEW VALLEY GOVERNORATE

KHLOUD AYMAN SAYED MOHAMED [2] ; SHERIEF MOHAMMED SAYED ABD-ALLAH [1] AND HESHAM ABDEL-MOEZ AHMED ISMAIL[1]

[1&2] Prof. of Meat Hygiene and Technology, Food Hygiene Department, Fac. of Vet. Med., Assiut University.
[3] Department of Food Hygiene, Meat Hygiene, Fac. Of Vet. Med., Assiut University

Received: 3 July 2022; **Accepted:** 5 August 2022

ABSTRACT

In the current study, a total of 100 ready-to-eat (RTE) sandwiches (50 of each) sausage and kofta (25 fried and 25 grilled) were collected randomly from fast food restaurants in Elkharga city, New Valley Governorate, Egypt for assessment of the hygienic (coliforms, fecal coliforms, *E. coli*. yeast, and mould counts) and nutritional (moisture, protein, fat, ash, carbohydrates, gross energy, and cholesterol content) quality. Coliforms was detected in 68, 76, and 72% of the examined RTE sandwiches of sausage, fried kofta and grilled kofta; and fecal coliforms in 8, 12, and 16% of the samples, respectively. *Escherichia coli* were found in 2, 4, and 12% of the samples, respectively. Pathogenic *E. coli* strains were identified from sausage (4), fried kofta (2) and grilled kofta (4) samples. The average yeast count was 4.68±0.17, 4.49±0.26, and 4.75±0.31 log_{10} cfu/g; while that of mould was 2.93±0.15, 2.94±0.15, and 2.88±0.14 log_{10} cfu/g, respectively. The average moisture content (%) was 55.05±0.49, 55.01±0.42, and 57.43±0.21; protein (%) was 15.19±0.30, 18.60±0.45, and 21.55±0.43; fat (%) was 11.82±0.20, 18.00±0.40, and 13.58±0.26; ash (%) was 3.32±0.09, 3.29±0.09, and 3.06±0.12; and carbohydrates (%) was 14.62±0.32, 5.10±0.54, and 4.38±0.26, respectively. The average gross energy content (Kcal/100g) was 225.6±2.76, 256.8±2.88, and 225.9±1.66, respectively. The average total cholesterol content (mg/100g) was 62.67±7.73, 52.25±7.47, and 59.58±10.21, respectively. In conclusion, despite nutritious RTE sandwiches under investigation; they may pose threats to public health (pathogenic bacteria and cholesterol). Fried kofta sandwiches showed better quality (low incidence of fecal coliforms and *E. coli*, and low total cholesterol content).

***Key Words*:** Ready-to-eat sandwiches, Sausage, Kofta, Quality, Microbial, Nutritional.

Corresponding author: Khloud Ayman Sayed
E-mail address: dlodyg4@gmail.com
Present address: Prof. of Meat Hygiene and Technology, Food Hygiene Department, Fac. of Vet. Med., Assiut University

INTRODUCTION

In recent years, a wide variety of ready-to-eat "RTE" sandwiches of meat products get consumer popular. Higher-income people obtained RTE sandwiches from restaurants and low-income people obtained them from street vendors. Typically, the term refers to food sold in a restaurant or store with low-quality preparation and served to the customer in packaged from take-out/take-away sandwiches (Mostafa, 2017). Such sandwiches provide a source of readily available and nutritious meals for the consumer being well appreciated because of their taste, low cost, nutrient value and ready availability for immediate consumption (WHO, 2002).

Despite the economic and nutritional benefits, many factors such as processing, handling, storage and display may increase the microbiological contamination of final RTE meat sandwiches at restaurants (Angelidis *et al.,* 2006; El-Ziqaty *et al.,* 2016).

Improper food handling practices based on unrespect of good hygienic practices influence the microbiological load at the point of sale (Estrada *et al.,* 2004). During handling, subsequent to the heat treatment, such foods can be contaminated with mesophilic gram-negative rods (e.g., *Enterobacteriaceae*), Gram-positive cocci and rods, yeasts or molds, or any combination of these that may render the product to be of inferior quality or unfit for human consumption. Contamination with bacteria takes place from hands and surfaces in contact with the cooked meats, and with molds from the air (ICMSF, 2005).

The presence of coliform in meat meals indicates inadequate processing and post-processing contamination (most probably from workers, dirty utensils and other contact surfaces). Their presence in large numbers can be contributing to economic losses and the likelihood of enteric pathogens posing threats to public health (Trout and Osburn, 1997).

Escherichia coli is one of the common diarrheagenic bacteria within the family Enterobacteriaceae (Torres *et al.,* 2005). It is recognized as a serious food-borne pathogen and has been associated with numerous outbreaks of disease (Scotter *et al.,* 2000). *E. coli* is heat sensitive so, its presence could refer to fecal contamination from the hands of food handlers (Lues *et al.,* 2006).

As a result of the annual increase in consumption of RTE sandwiches of meat products in Egypt, and as the dependence on such foods is more interesting in its convenience than in its safety and hygiene, so it is important to survey the nutrition quality and hygienic state. The present study was designed to evaluate the hygienic (coliforms, yeasts, and moulds) and nutritional (protein, fat, carbohydrates, energy, and cholesterol) quality of kofta and sausage sandwiches collected from fast food restaurants at El Kharga city, New Valley Governorate, Egypt.

MATERIAL AND METHODS

1. Collection of Samples

A total of 100 ready-to-eat sandwiches were collected at random from fast food restaurants in El kharga city, New Valley governorate, Egypt. The collected sandwiches include 50 from each sausage and kofta (25 fried and 25 grilled). Sandwiches were kept in sterile plastic bags under chilled condition in an icebox. The samples were transferred directly to the laboratory of the Meat Hygiene section, Department of food hygiene, Faculty of Veterinary Medicine, Assiut University for analysis.

2. Preparation of samples

At the laboratory, the samples were subjected to sensory evaluation, and then the content of each sandwich was collected and mixed well in sterile mortar while the bread portion was discarded.

The organoleptic evaluation was focused on the detection of objectionable appearance, odor or texture with general acceptability. If any faults were found, then they would be reported.

3. Bacteriological examination

3.1. Preparation of food homogenate

Ten grams of the well-mixed sample were weighed aseptically into a sterile bag and homogenized with 90ml of 0.1% sterile peptone water for 2 min using a laboratory stomacher (Seward 400) to prepare a dilution of 10^1. Subsequent ten folds serial dilutions were then prepared from the original homogenate using the same diluent.

3.2. Coliforms count (MPN/g) (AOAC, 1980)

Lauryl Sulphate Tryptose (LST) broth was used for the presumptive count and Brilliant Green Bile 2% (BGB) broth for the confirmatory count. Tubes showing turbidity and gas production were recorded and the number of coliforms/g was calculated from MPN tables for the 3 tubes dilutions.

3.3 Fecal coliforms count (MPN/g) (AOAC, 1980)

EC broth was used. Positive tubes showing turbidity and gas production were collected in Durham's.

3.4. *E. coli* count (MPN/g) (AOAC, 1980)

Eosine Methylene blue (EMB) agar plates were used. Typical nucleated (dark center) colonies with or without metallic sheen were considered to be *E. coli*. The numbers of *E. coli*/g were calculated from MPN tables for 3 tubes dilutions.

4.5. Identification of Enteropathogenic *E. coli:*

Purified suspected isolates of *E. coli* were biochemically identified according to MacFaddin (2000). IMVC, urease, TSI and Sugars fermentation were among the tests performed, followed by serological identification by slid agglutination test according to Kok *et al.* (1996) using rapid diagnostic *E. coli* antisera sets (DENKA SEIKEN Co., Japan). Both biochemical and serological identification was performed in the lab of microbiology, Benha University, Egypt.

4.6. Mould and yeast count (FAO, 1992)

Malt Extract Agar was used; incubated at 25 °c for up to 5 days. The colonies were counted and the mould and the yeast count/g were calculated and recorded.

5. Chemical Analysis

5.1. Determination of moisture percentage (AOAC, 2012)

Twenty grams of the prepared sample were used; dried at 65°C in Drying Oven (Blue Pard Scientific Instrument Co LTD, Taiwan) for 24 hr then at 105°C for 6 hr.

The moisture percentage was calculated according to the following equation

$$\text{Moisture \%} = \frac{W1 - W2}{W} \times 100$$

W=weight the sample

W1=weight of the dish with the sample before drying

W2=weight of the dish with the sample after drying

5.2. Determination of crude protein content (Macro-Kjeldhal method) (AOAC, 2006)

From the dried sample, 0.5gm was used, and the factor 6.25 was applied to convert nitrogen percentage to protein.

5.3. Determination of fat percentage (AOAC, 2000)

The soxhlet method was used with slight modification. One gram from the well-dried sample was weighed, wrapped in filter paper of known weight and transferred to the thimble of the Soxhlet apparatus. The extraction was carried out using petroleum ether (60/80) for 16hr. The fat percentage was calculated as the following:

$$\text{Fat\% (dry basis)} = \frac{W1 - W2}{a} \times 100$$

W1= weight of the filter paper with the sample before extraction

W2 = weight of the filter paper with the sample after extraction.

a = weight of the sample.

5.4. Determination of ash percentage (AOAC, 2006)

One gram of the dried sample was used; ignited in a muffle furnace (Thermo Scientific, Thermolyne 6000 Furnace, USA) at 550-600°C for 6hrs. The ash percentage was calculated as the following:

$$\text{Ash\% (dry basis)} = \frac{\text{Weight of ash}}{\text{Weight of sample}} \times 100$$

N.B. All calculations on dry basis were converted to wet basis using the equation of **Jurgens and Bregendahl (2007)**:

$$\text{Material wet basis\%} = \frac{\text{Material dry basis\%} \times \text{Dry matter\%}}{100}$$

5.5. Calculation of total carbohydrate percentage:

Total carbohydrate % =100 - (moisture% + protein% (wet basis) + fat% (wet basis) + ash % (wet basis))

5.6. Calculation of the gross energy value: Merrill and Watt (1973)

Gross energy value (kcal/100g) = (Protein% x 4) + (Fat% x 9) + (Carbohydrate% x 4)

6. Determination of total cholesterol content:

Three steps were applied including; extraction of fat from the sample (Bligh and Dyer, 1959), preparation of the lipid extract for cholesterol determination (Naeemi *et al.*, 1995),

and Enzymatic determination of cholesterol (Pasin *et al.,* 1998) using diagnostic cholesterol reagent(CHOD-PAP, Ref: 230001, Spectrum, S.A.E.). The absorbance was measured using the spectrophotometer (Unico 2100UV, USA) at wavelength 546 nm. Total cholesterol content was calculated as the following

$$\text{Cholesterol “mg/100 g”} = \frac{A\ sample}{A\ standard} \times 200$$

A sample= absorbance of the sample.

A standard= absorbance of standard.

6. Statistical analysis

Statistical analysis was performed using SPSS version 19. The results were expressed as mean ± standard error. One-way ANOVA followed by Turkey's post hoc test was used to compare the data of the various ready-to-eat meat products. The mean difference was considered significant at $p< 0.05$.

RESULTS

Table 1: Statistical results of microbial count (MPN/g) of examined RTE sandwiches samples.

Item	Coliforms		Fecal coliforms		E. coli		Yeast		Mould	
	+ve[1] (%)	Count[2]	+ve[1] (%)	Count[2]	+ve[1] (%)	Count[2]	+ve[1] (%)	Count[3]	+ve[1] (%)	Count[3]
Sausage (n=50)	34 (68%)	350 (3.6->1100)	4 (8%)	3.6 (3-460)	1 (2%)	16	41 (82%)	4.68± 0.17[a]	35 (70%)	2.93± 0.15[a]
Kofta fried (n=25)	19 (76%)	>1100 (3.6->1100)	3 (12%)	21 (3.6-43)	1 (4%)	9.1	21 (84%)	4.49± 0.26[a]	15 (60%)	2.94± 0.15[a]
Kofta grilled (n=25)	18 (72%)	>1100 (3->1100)	4 (16%)	32 (11-1100)	3 (12%)	6 (3-9.1)	20 (80%)	4.75± 0.31[a]	21 (84%)	2.88± 0.14[a]

[1]Positive samples; [2]Median value (MPN/g); [3]Mean value (log_{10} cfu/g)
In the same column means with different superscripts are significantly different (P<0.05)

Table 2: Prevalence of Enteropathogenic *E. coli* isolated from the examined RTE sandwiches samples.

E. coli strain	Sausage	Kofta fried	Kofta grilled	Strain characterization
O146 : H21	1	-	-	EPEC
O26 : H11	2	-	-	EHEC
O91 : H21	-	1	-	EHEC
O78	-	-	1	EPEC
O127 : H6	1	1	1	ETEC
O121 : H7	-	-	1	EPEC
O159	-	-	1	EIEC

Table 3: Mean values of proximate composition (%) of examined RTE sandwiches samples.

Item	Moisture	Protein	Fat	Ash	Carbohydrates
Sausage (n=50)	55.05± 0.49^{b}	15.19± 0.30^{c}	11.82± 0.20^{c}	3.32±0.09^{a}	14.62±0.32^{a}
Kofta fried (n=25)	55.01± 0.42^{b}	18.60± 0.45^{b}	18.00± 0.40^{a}	3.29±0.09^{a}	5.10±0.54^{b}
Kofta grilled (n=25)	57.43± 0.21^{a}	21.55± 0.43^{a}	13.58± 0.26^{b}	3.06±0.12^{a}	4.38±0.26^{b}

In the same column means with different superscripts are significantly different (P<0.05)

Table 4: Statistical results of the energy content of the examined RTE sandwiches samples.

Item	Gross energy (Kcal/100g)	EP (%)[1]	EF (%)[2]	ECb (%)[3]
Sausage (n=50)	225.6±2.76^{b}	26.93±0.40^{c}	46.99±0.44^{b}	26.08±0.54^{a}
Kofta fried (n=25)	256.8±2.88^{a}	29.21±0.85^{b}	62.83±0.84^{a}	7.96±0.85^{b}
Kofta grilled (n=25)	225.9±1.66^{b}	38.37±0.92^{a}	53.91±0.74^{c}	7.72±0.44^{b}

[1] Calories percentage derived from protein; [2] Calories percentage derived from fat; [3] Calories percentage derived from carbohydrates
In the same column means with different superscripts are significantly different (P<0.05)

Table 5: Mean values of total cholesterol content (mg/100g) of examined RTE sandwiches samples.

	Sausage (n=50)	Kofta fried (n=25)	Kofta grilled (n=25)
Total cholesterol	62.67±7.73^{a} (17.51-286.1)	52.25±7.47^{b} (13.7-171.5)	59.58±10.21^{a} (14.69-183.2)

In the same row means with different superscripts are significantly different (P<0.05)

DISCUSSION

A huge number of consumers feed daily with a wide variety of ready-to-eat food. Dependence on such food is more interesting in its convenience than in its safety and hygiene (Mensah *et al.,* 2002). Ready-to-eat sandwiches can be exposed to several ways of contamination through improper preparation and handling. The risk of contamination is increased by adding contaminants at the stage after which no further heat treatment was applied (Ehirl *et al.,* 2001). However, they are considered a good source of a wide variety of easily digestible nutrients, supplying the consumers with protein, fat, carbohydrates and energy (Mohammed *et al.,* 2010).

The present study planned to assess the hygienic and nutritional quality of ready-to-eat sausage and kofta sandwiches obtained from fast food restaurants in El kharga city, New Valley governorate, Egypt.

Hygienic quality:

The sensory assessment revealed all samples were accepted with no obvious faults detected.

The results declared that coliforms were detected in 68, 76, and 72% of the examined ready-to-eat sandwiches of sausage, fried kofta and grilled kofta, with a median count of 350, >1100 and >1100 MPN/g, respectively. However, fecal coliforms were detected in 8, 12, and 16 % of the samples with median values of 3.6, 21, and 32 MPN/g, respectively. Fried kofta sandwiches showed a higher incidence of coliforms, while grilled kofta showed a higher incidence of fecal coliforms (Table 1).

A lower incidence (50%), but close coliforms count was found by Gaafar *et al.* (2019) in beef kofta sandwiches obtained from Benha city, Qalubiya governorate; however, Sabry *et al.* (2019) recorded a lower incidence (63.33%), but higher count ($2.17x10^3$). Likewise, a higher count was recorded by Hemmat-Ibrahim *et al.* (2020) in grilled kofta obtained from restaurants in Benha city, and by Shaltout *et al.* (2020) examined beef kofta obtained from restaurants in Tanta city. Hassan *et al.* (2015) assumed a higher count of total coliforms in beef kofta meals obtained from two hotels in Cairo governorate.

Shaltout *et al.* (2015) recorded close coliform count from kofta and higher count from sausage sandwiches obtained from street vendors at Qalubiya governorate; mean while Shaltout *et al.* (2016) and Shaltout *et al.* (2017) recorded higher count in both kofta and sausage samples obtained from restaurants in Benha city.

Presence of coliform in meat meals indicates inadequate processing and post-processing contamination (most

probably from workers, dirty utensils and other contact surfaces or from polluted water, soil and manure) (Tabbutt, 1989). The large number of coliform bacteria can be responsible for poorer food quality contributing to economic losses and the likelihood of enteric pathogens posing threats to public health (Trout and Osburn, 1997). Fecal coliforms had been used as an indicator for fecal contamination of food (Shaltout *et al*., 2019).

Escherichia coli were detected in 2, 4, and 12% of the examined sausage, fried kofta, and grilled kofta sandwiches samples, with a count of 16, 9.1, and 3 - 9.1 MPN/g, respectively. The higher incidence was in grilled kofta sandwiches (Table 1). The identified strains were, O146:H21 (1 strain), O26:H11 (2 strains), and O127:H6 (1 strain) from sausage sandwiches, and O91:H21 and O127:H6 (1 strain each) from fried kofta, while from grilled kofta were O78, O127:H6, O121:H7, O159 (1 strain each) (Table 2).

Hassan *et al.* (2015) in Menofia governorate and Shaltout *et al.* (2020) in Tanta city declared higher incidence (26.67 and 20%, respectively) of *E. coli* in beef Kofta sandwiches from fast food restaurants. Lower incidence (10%) was found by Gaafar *et al.* (2019) and Hemmat-Ibrahim *et al.* (2020) in samples from restaurants in Benha city, but nearly similar incidence (16.67%) by Sabry *et al.* (2019).

Shaltout *et al.* (2015) and Shaltout *et al.* (2016) recorded a close incidence of *E. coli* in kofta but higher in sausage sandwiches in the Qalubiya governorate.

In previous studies, various enteropathogenic *E. coli* serotypes were identified from kofta and sausage sandwiches (Hassan *et al.*, 2015; Shaltout *et al.*, 2015; Saad *et al.*, 2018; Gaafar *et al.*, 2019; Sabry *et al.*, 2019; Hemmat-Ibrahim *et al.*, 2020; and Shaltout *et al.*, 2020).

According to our knowledge, no standards for microbiological criteria of ready-to-eat sandwiches were released by the Egyptian authorities. However, the Centre for Food Safety (2014) in Hong Kong declared the allowed level of hygiene indicator organisms in ready-to-eat food (*Escherichia coli* (cfu/g): "<20 satisfactory", "20 - $\leq 10^2$ borderline", "$>10^2$ unsatisfactory". In relation to that, *E. coli* count recorded in sandwiches under investigation was satisfactory (<20 cfu/g) for all examined samples with the high count recorded for sausage.

Escherichia coli are considered one of the common diarrheagenic bacteria (Torres *et al.*, 2005), and was recognized as a serious food-borne pathogen associated with numerous outbreaks of disease (Scotter *et al.*, 2000); causes illness ranging from gastrointestinal tract-related

complications such as diarrhea and dysentery, to urinary tract infection, pneumonia and even meningitis (Johnson *et al.,* 2006; Jackson *et al.*, 2013).

Escherichia coli are heat sensitive so, its presence could be referred to fecal contamination post-cooking (Lues *et al.,* 2006).

Contamination of food with fungi is common from the surrounding environment under improper condition of hygiene (Nasser, 2015). Mould contamination was found in 70, 60, and 84% of the examined sandwiches samples, with an average count of 2.93±0.15, 2.94±0.15, and 2.88±0.14 $\log_{10}$ cfu/g, respectively. On the other hand, Yeast was recorded in 82, 84, and 80% of the examined sausage, fried kofta, and grilled kofta sandwiches with an average count of 4.68±0.17, 4.49±0.26, and 4.75±0.31 $\log_{10}$ cfu/g, respectively (Table 1). Higher incidence of mould found in grilled kofta.

Nutritional quality:

Ready to eat meals are excellent concentrated nutrient sources which contain protein with a high digestibility score, essential amino acids, fatty acids and minerals which are considered essential to optimal human growth and development (Vasut and Robeci, 2009). They provide a source of readily available and nutritious meals to consumers (Morshdy *et al.,* 2018). Because their consumption increases annually, so it is important to know nutrition quality (protein, fat, carbohydrates and energy).

The data in Table (3) showed that the average moisture content (%) of sausage, fried kofta, and grilled kofta sandwiches was 55.05±0.49, 55.01±0.42, and 57.43±0.21, respectively. Grilled kofta samples showed higher moisture content ($P<0.05$)

Protein average value (%) was 15.19±0.30, 18.60±0.45, and 21.55±0.43, respectively; while fat average (%) was 11.82±0.20, 18.00±0.40, and 13.58±0.26, respectively (Table 3). Higher protein content was recorded in grilled kofta, followed by fried kofta, while higher fat content was found in fried kofta than in grilled kofta sandwiches. Sausage samples recorded lower content of protein and fat ($P<0.05$).

The average value of ash content (%) was 3.32±0.09, 3.29±0.09, and 3.06±0.12; and of carbohydrates (%) was 14.62±0.32, 5.10±0.54, and 4.38±0.26, respectively (Table 3). Samples of sausage showed the higher carbohydrates content ($P<0.05$), which may correlated to additives during manufacture.

The average gross energy content (Kcal/100g) of the sausage sandwiches samples was 225.6±2.76,

with the highest percentage of energy (46.99±0.44 %) provided from fat followed by protein and carbohydrates equally. For fried kofta the average gross energy content was 256.8±2.88; and for grilled kofta was 225.9±1.66 with the highest percentage of energy provided from fat (62.83±0.84 and 53.91±0.74 %, respectively) followed by protein (Table 4). Fried kofta showed higher gross energy content.

Mohamed *et al.* (2010) estimated higher protein (20.5%) and carbohydrate (25.58%), but lower ash (1.86%) mean values in sausage sandwiches obtained from restaurants at Cairo and Giza Governorates.

Average total cholesterol content (mg/100g) was 62.67±7.73, 52.25±7.47, and 59.58±10.21 in examined sausage, fried kofta, and grilled kofta sandwiches samples, respectively (Table 5). Fried kofta presented lower total cholesterol content. This might be related to the intrinsic volume of the lipid constituent (which has less saturated fat) as fried foods absorb the oil (unsaturated fat) during frying at varying degrees, depending on the lipid absorptivity of the food (Ling, 2015).

In conclusion, results from issues under investigation assumed a higher incidence of fecal coliforms, *E. coli* and moulds in grilled kofta. Sausage sandwiches recorded lower content of protein and higher total cholesterol. Fried kofta showed fairly lower incidence of *E. coli* and moulds, and lower total cholesterol content. The major percentage of calories provided from fat. Ready-to-eat sandwiches under investigation may pose threats to public health, especially those of sausage. Sandwiches of fried kofta showed better quality (low incidence of fecal coliforms, *E. coli*, and moulds and lower total cholesterol content). It is to be recommended to follow good hygienic practices during preparation and handling at the point of sale; avoid adding contaminated ingredients at the stage where no further heat treatment was applied; avoid post-cooking holding for long times; plenty of uncontaminated green salad should be supplied with the sandwiches; people should be educated about the hazards and benefits of such meals; Egyptian standards for ready to eat sandwiches need to be established.

REFERENCES

Angelidis, A.S.; Chronis, E.N.; Papageorgiou, D.K.; Kazakis, I.I.; Arsenoglou, K.C. and Stathopoulos, G.A. (2006): Non-lactic acid contaminating flora in ready-to-eat foods: A potential food-quality index. Food Microbiology, 23: 95–100.

AOAC (1980): Association of Official Analytical Chemists. Official Methods of Analysis of the American of Official Analytical Chemists, 13th ed.

Horwitz, W. (Edit). Washington, DC.

AOAC (2000): Official Methods of Analysis, 17thed. Association of Analytical Chemists, Gaithersburg, MD, USA.

AOAC (2006): Official Methods of Analysis, 18thed. Association of Analytical Chemists, Arlington. VA.

AOAC (2012): Official Methods of Analysis of AOAC International, 19thed. AOAC, Washington, DC.

Bligh, E.G. and Dyer, W.J. (1959): A rapid method of total lipid extraction and purification. Can. J. Biochem. Physiol., 37(58): 911-917.

Centre for Food Safety (2014): Microbiological Guidelines for Food "For ready-to-eat food in general and specific food items". The Centre for Food Safety, Food and Environmental Hygiene Department, Queensway, Hong Kong.

Ehirl, J.E.J.; Azubuike, M.C.; Ubbaonu, C.N.; Anyanwu, E.G.; Lbe, K. and Ogbonna, M.O. (2001): Critical control points of complementary food preparation and handling in eastern Nigeria. Bull World Health Organ, 79 (5): 423 – 433.

El-Ziqaty, A.A. (2016): Microbial Evaluation of Some Street Vended Meat Meals. Thesis Meat Hygiene, Fac. Vet. Med., Alexandria University, Egypt.

Estrada, G.T.; Lopez-Saucedo, C.; Zamarripa, A.B.; Thompson, M.R.; Gutierrez-Cogco, L.; Mancera-Martinez, A and Escobar, G.A. (2004): Prevalence of *Escherichia coli* and *Salmonella spp.* in street-vended food of open markets (tianguis) and general hygienic and trading practices in Mexico City. Epidemiology and Infection Journal, 132 (6): 1181-1184.

FAO "Food and Agriculture Organization" (1992): Escherichia coli and other coliforms. Manual of food quality control. Rev.1-Microbiological Analysis, Food and Agriculture Organization of the United Nation, Rome, Italy, Chap. 3PP, 13-26.

Gaafar, R.; Hasanine, F.; Shaltout, F. and Zaghloul, M. (2019): Hygienic profile of some ready to eat meat product sandwiches sold in Benha city, Qalubiya Governorate, Egypt. Benha Vet. Med. J. 37(1): 16-21.

Hassan, M.A.; Nada, Shiamaa. M. and El-hanafy, Asmaa. R. (2015): Occurrence of *Escherichia coli* in Fast Foods at Restaurant level. Benha Vet. Med. J. 29 (2): 182-186.

Hassan, M.A.; Reham A. Amin and El-Salhy, M.S. (2015): Bacteriological and Chemical

Evaluation of Meat Meals in Some Egyptian Hotels. Benha Vet. Med. J. 29 (2):80-91.

Hemmat-Ibrahim, M.; Eleiwa-Nesreen, Z. and Desoki-Heba, A. (2020): Bacterial and chemical quality of raw meat and ready-to-eat cooked meat. Benha Vet. M. J. 39: 95-99.

ICMSF "International Commission on Microbiological Specification for Food" (2005): Microorganisms in Foods. Microbial Ecology of Foods Commodities. 2nd Ed. Kluwer Academic /Plenum Publishers, New York, Boston, Dordrecht, London, Moscow.

Jackson, B.R.; Griffin, P.M.; Cole, D.; Walsh, K. and Chai, S.J. (2013): Outbreak associated *Salmonella enterica* serotypes and food commodities, United States, 1998-2008. Emerged Infectious Diseases J., 19(8): 1239-1244.

Johnson, J.; Kuskowki, M.; Menard, M.; Gajewski, A.; Xercavins, M. and Garau, J. (2006): Similarity between human and chicken *Escherichia coli* isolates in relation to ciprofloxacin resistance status. Infectious Diseases J., 194(1): 71-78.

Jurgens, M.H. and Bregendahl, K. (2007): Animal Feeding and Nutrition 10th Edition. Kendall/ Hunt Publishing Company, Lowa, USA.

Kok, T.; Worswich, D. and Gowans, E. (1996): Some serological techniques for microbial and viral infections. In Practical Medical Microbiology (Collee, J.; Fraser, A.; Marmion, B. and Simmons, A., eds.), 14th ed., Edinburgh, Churchill Livingstone, UK.

Ling, T. (2015): Oxidation of polyunsaturated fatty acids and its impact on food quality and human health. Advances in Food Technology and Nutritional Sciences, 1(6): 135-142.

Lues, J.; Rasephei, M.; Venter, P. and Theron, M. (2006): Assessing food safety and associated food-handling practices in Street food vending. Int. J. Enviro. Heal. Res., 16: 319–328.

MacFaddin, J.F. (2000): Biochemical tests for identification medical bacteria. Warery Press Inc. Baltimore, Md. 21202 USA.

Mensah, P.; Yeboah-Manu, D.; Owusu-Darko, K. and Ablordey, A. (2002): Street foods in Accra, Ghana: How safe are they?. Bull. World Health Organization, 80(7): 546-554.

Merrill, A.L. and Watt, B.K. (1973): Energy Value of Foods: Basis and Derivation. Agriculture Handbook No. 74, Agriculture Research Service, Unitated States Department of Agriculture, Washington, DC.

Mohamed, I. Ali; Magda, A. El-Meleigy; Rawhia, A. Arafa; Atef, H. El Sayed; Nabih, A. Ebrahim and Ebtehal, E. EL-Kholany (2010): Microbiologiacal and Chemical Studies on Some Meat Products Sold In EGYPT. N. Egypt. J. Microbial.

Morshdy, A.M.; Mohamed, A.H.; Ahmed E.T. and Fakhry, B.F. (2018): Microbial Profile of Ready to Eat Meat Sandwiches. International Food Safety Conference Damanhour University.

Mostafa, E.M.A. (2017): Incidence of some food poisoning microorganisms in ready to eat fast food thesis Ph.D. (Meat Hygiene Fac. Vet. Med. Benha. Univ. Egypt.

Naeemi, E.D.; Ahmed, N.; AL-Sharrah, T.K. and Behbahani, M. (1995): Rapid and simple method for determination of cholesterol in processed food. J. of AOAC Int., 78(6): 1522-1524.

Nasser, L.A. (2015): Molecular identification of isolated fungi, microbial and heavy metal contamination of canned meat products sold in Riyadh, Saudi Arabia. Saudi Journal of Biological Sciences 22(5): 513-520.

Pasin, G.; Smith, G.M. and Mahony, O.M. (1998): Rapid determination of total cholesterol in egg yolk using commercial diagnostic cholesterol reagent. Food Chemistry, 61 (1-2): 255-259.

Saad, M.S.; Abouel-Roose, N.A. and El-Shazly, E. (2018): Food poisoning bacteria in meat -based sandwiches. Benha Vet. Med. J., 35 (1): 228-235.

Sabry, R.; Hassan, A.M.; Zaghloul, M. and Ibrahim, H. Mostafa (2019): Quality indices of some ready-to-eat meat products. Benha Vet. Med. J., 37: 37-40.

Scotter, S.; Aldridge, M. and Capps, K. (2000): "Validation of method for detection of *E. coli* O157:H7 in foods". Food Control, 11:85-95.

Shaltot, F.A.; Mohamed, A.H. El-Shater and Wafaa, M. Abd El-Aziz (2015): Bacteriological assessment of Street Vended Meat Products sandwiches in kalyobia Governorate. Benha Vet. Med. J, 28(2): 58-66.

Shaltout, F.A.; Ali, A.M. and Rashad, S.M. (2016): Bacterial Contamination of Fast Foods. Benha. J. Applied. Sciences. 1(2): 45-51.

Shaltout, F.A.; Farouk, M.; Ibrahim, H.A.A. and Afifi, M.E.M. (2017): Incidence of coliform and *Staphylococcus aureus* in ready to eat fast foods. Benha Vet. Med. J. 32(1): 13-17.

Shaltout, F.A.; Nassif, M.Z.; Lotfy, L.M. and Gamil, B.T. (2019):

Microbiological status of Chicken cuts and its products. Benha Vet. Med. J. 37 (1): 57-63.

Tabbutt, C.M. (1989): Microbiological contamination of cooked meats and environmental site in premise selling both raw and cooked meat products. Intl. Environm. Health Research. 3(4):209-216.

Torres, A.G.; Zhou, X. and Kaper, J.B. (2005): Adherence of diarrheagenic *Escherichia coli* strains to epithelial cells. Infect. Immun., 73: 18-29.

Trout, H. and Osburn, B. (1997): Meat from dairy cows possible microbiological hazards and risks. Rev. Sci. Technol., 16(2): 405-414.

Vasut, R.G. and Robeci, D.M. (2009): Food contamination with psychrophilic bacteria, Lucrări stiinłifice medicină veterinară, XII (2): 325-330.

WHO (2002): Risk Assessment of Salmonella in eggs and broiler chickens. Food and Agriculture Organization of the United Nations and World Health Organization (FAO/WHO), Geneva, Switzerland.

تقييم الجودة الصحية و الغذائية لساندوتشات الكفته وساندوتشات السجق في محافظة الوادي الجديد

خلود أيمن سيد محمد ، شريف محمد سيد عبد الله ، هشام عبدالمعز أحمد إسماعيل

E-mail : dlodyg4@gmail.com Assiut University web-site: www.aun.edu.eg

في الدراسة الحالية ، تم جمع عدد ١٠٠ ساندويتش جاهز للأكل ٥٠ من كل من السجق والكفتة (٢٥ مقلي و ٢٥ مشوي) بشكل عشوائي من مطاعم الوجبات السريعة في مدينة الخارجة ، محافظة الوادي الجديد ، مصر ، لتقييم الحالة الصحية (القولونيات ، القولونيات البرازية ، الإيشريكية القولونية ، الخميرة ،والعفن) والجودة الغذائية (الرطوبة ، البروتين ، الدهون ، الرماد ، الكربوهيدرات ، الطاقة الكلية ،و محتوى الكوليسترول).

كانت جميع العينات مقبولة من الناحية الحسية. أظهرت النتائج وجود البكتيريا القولونية في عينات ساندوتشات السجق ،الكفتة المقلية ،والكفتة المشوية بنسبة ٦٨ ، ٧٦ ،و ٧٢٪ من العينات ؛ والقولونيات البرازية في ٨ ، ١٢ ،و ١٦٪ من العينات، على التوالي. تم العثور على الإيشريكية القولونية في ٢ ، ٤ ،و ١٢٪ من العينات ، بعدد ١٦ ، ٩,١ ، و ٣ - ٩,١ عد احتمالى/جم، على التوالي. تم التعرف على سلالات مختلفة من الإيشريكية القولونية الممرضة من عينات السجق (٤ سلالات) والكفتة المقلية (سلالتين) والكفتة المشوية (٤ سلالات). كان متوسط عدد الخمائر ٤,٦٨ ± ٠,١٧ ، ٤,٤٩ ± ٠,٢٦ ،و ٤,٧٥ ± ٠,٣١ ؛ و في حالة العفن كان ٢,٩٣ ± ٠,١٥ ، ٢,٩٤ ± ٠,١٥ ،و ٢,٨٨ ± ٠,١٤ لو.١خلية/جم، على التوالي.

كان متوسط محتوى الرطوبة (٪) هو ٥٥,٠٥ ± ٠,٤٩ ، ٥٥,٠١ ± ٠,٤٢ ،و ٥٧,٤٣ ± ٠,٢١ ؛ البروتين (٪) كان ١٥,١٩ ± ٠,٣٠ ، ١٨,٦٠ ± ٠,٤٥ ،و ٢١,٥٥ ± ٠,٤٣ ؛ الدهون (٪) كانت ١١,٨٢ ± ٠,٢٠ ، ١٨,٠٠ ± ٠,٤٠ ،و ١٣,٥٨ ± ٠,٢٦ ؛ الرماد (٪) ٣,٣٢ ± ٠,٠٩ ، ٣,٢٩ ± ٠,٠٩ ،و ٣,٠٦ ± ٠,١٢ ؛والكربوهيدرات (٪) كانت ١٤,٦٢ ± ٠,٣٢ ، ٥,١٠ ± ٠,٥٤ ،و ٤,٣٨ ± ٠,٢٦ ، على التوالي. كان متوسط محتوى الطاقة الكلية (كيلو كالوري/ ١٠٠جم) للعينات هو ٢٢٥,٦ ± ٢,٧٦ ، ٢٥٦,٨ ± ٢,٨٨ ،و ٢٢٥,٩ ± ١,٦٦ ، على التوالي ؛ وكانت اعلى نسبة طاقة مصدرها الدهون. كان متوسط محتوى الكوليسترول الكلي (ملجم / ١٠٠ جم) هو ٦٢,٦٧ ± ٧,٧٣ ، ٥٢,٢٥ ± ٧,٤٧ ،و ٥٩,٥٨ ± ١٠,٢١ في العينات التي تم فحصها ، على التوالي. خلصت الدراسة إلى أنه على الرغم من أن الساندوتشات الجاهزة للأكل محل الدراسة ذات قيمة غذائية إلا أنها قد تشكل تهديد لصحة المستهلك (نسبة الكوليسترول المرتفعة و بكتيريا التسمم الغذائي). أظهرت ساندوتشات الكفتة المقلية أفضل جودة صحية وغذائية (نسبة منخفضة من القولونيات البرازية والإيشريكية القولونية ، ومن محتوى الكوليسترول الكلي).

الكلمات الكاشفة: ساندوتشات جاهزة للأكل ، سجق ، كفتة ، الجودة ، ميكروبية ، غذائية.