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Determination of some food additives, chemical composition, bacteriological quality, and physicochemical examination of some meat products

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Abstract

The present investigation designed for monitoring the safety and quality of some meat products (traditional Egyptian beef luncheon, oriental sausage and beef burger) to give awareness for consumers about their nutritional values in contrast to their dangers. So, different meat products were collected from Cairo and Giza governorates. A total of sixty samples were randomly selected and evaluated for bacteriological, physicochemical examination, and determination of some chemical additives (phosphate, sorbic, ascorbic, benzoic acids and Monosodium Glutamate). The results for luncheon, oriental sausage and beef burger showed high aerobic bacterial counts (4.40, 5.49 and 4.71 $\log_{10}$ CFU/g, respectively), Enterobacteriaceae (2.86, 3.37 and 2.87 $\log_{10}$ CFU/g, respectively), *E. coli* (2.33, 2.71 and 2.73 $\log_{10}$ CFU/g, respectively) and *S. aureus* (2.11, 2.68 and 2.50 $\log_{10}$ CFU/g, respectively). The aerobic bacterial count, *E. Coli* and *S. aureus* for luncheon, as well as *E. Coli* and *S. aureus* for oriental sausage and burger exceeded the E.S.S permitted limits. **Total volatile basic nitrogen (TVBN)** and **Thiobarbituric Acid (TBA)** values were within the permitted limits except TBA for oriental sausage. The protein and fat levels were below E.S.S limits. The mean results of chemical additives determined in luncheon, oriental sausage and burger for phosphate (4915.64, 5518.33, and 4245.69 ppm, respectively), for sorbic acid (79.10, 61.92, and 20.82 ppm, respectively), for ascorbic acid (40.99, 14.65, and 16.88 ppm, respectively), for benzoic acid (1569, 1899, and 0.00 ppm respectively), for MSG (4347.18, 1788.14, and 1226.75 ppm, respectively). The results of chemical additives examined in luncheon, oriental sausage and burger exceeded permitted limits according to E.S.S. and Codex for phosphate. Consequently, consumers should reduce the consumption of such meat products due to their public health hazards.

keywords: Bacteriological Quality, chemical composition, benzoic acid, Phosphate, MSG.

1.INTRODUCTION:

Meat is a vital part of a nutrition that is balanced. High-quality meat is greatly needed by the meat commercial [1] **&** [2]. Several meat products are essential foundations of vitamins as A, folic acid, B12, selenium and rise to hemoglobin, which are not present in plant-based meals [3]. All customers do desire to purchase beef products that are healthy. As a result, they are raising for food contractors and placing more effort on quality and safety [4]**,** [5] **&** [6]. Several factors contributed to the request for meat products, such as the need for original flavours, preservation, and reduced fat and calorie content. Therefore, it is essential for public health that the fresh material (beef), as well as the additives and final commodities are of high quality. low-quality meat products are formed from processing low-quality raw materials [7]**.**Chemical preservatives are critical to avoiding food spoilage. Depending on their purpose and mode of action preservatives can be antibacterial, antioxidants, improved nutrition, greater emulsification, or some substances that target the food's own enzymes [8] **&** [9].

For a variety of purposes, including increasing the meat's flavour, colour, and sensory attributes like tenderness and juiciness so phosphate is added to meat products. Additionally, they balance pH levels, extend the beef products' shelf life, increase water retention for larger yields, and lessen weight loss while cooking. Furthermore, using of phosphate in beef products offers consumers a nutritional source of phosphorus, a nutrient required for human existence [10].However, an extreme intake of phosphates can be harmful. The presence of hazardous heavy metals in phosphate additions can cause them to exhibit cytotoxic actions [11].

Both sorbic and benzoic acid are the two commonly used food preservatives to extend food goods' life span. It is combined with these preservative foods to prevent degradation, impede the development of contaminants, and extend the overall freshness of the products [12]. Despite being Generally Recognized as Safe (GRAS), sorbic and benzoic acid have been related to a higher risk of allergic reactions in humans. Such reactions can manifest as asthma, weak clastogenic activity, urticaria, rash, migraine, hyperkalemia, non-immunological contact urticaria, convulsions, metabolic acidosis, and hyperpnea [13] **&** [14]. Moreover, when sorbic is combined with ascorbic acid there is an opportunity that DNA disruption and mutation will manifest [15].

Monosodium glutamate (MSG) is the commonly used, easily obtained an amino acid that is employed to improve flavour [16]. It created umami, a unique flavour that cannot be compared to the other sensations of sourness, saltiness, or bitterness. Glutamate is

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a source of energy for numerous tissues as well as a substrate for the formation of glutathione in the body [17]**.** More studies have shown that high doses of MSG consumption are harmful and genotoxic to humans [18]. Numerous quality checks and analyses were conducted to ensure that beef products are of the highest caliber. The numerous barriers that prevent food processing facilities in developing countries from implementing the HACCP system, such as costs, a lack of professionals, and supervision, have led to the identification of several safety and fraud issues due to such limitations, even in products of premium quality [19]. The comparison assessed the calibre of the goods as well as safety from a number of dimensions using chemical and bacteriological analyses. The bacteriological tests included looking for *Aerobic plate count (APC),* Psychrotrophs *Enterobacteriaceae,* Salmonella, *E. coli* and *S. aureus.*

To understand the intactness of the beef products that were the focus of this investigation, three groups of chemical tests were undertaken. To assess the level of degradation, the Total Volatile Basic Nitrogen (TVBN) and the Thiobarbituric Acid Reactive Substances (TBARs) values have been analysed in the first testing round. The second series of chemical tests consisted of compositional tests to compare the protein and fat contents to the guidelines specified by the Egyptian food audit authority. The third group to assess the quantity of additives in the final products.

3. Materials and Procedures

3.1. Ethical approval

These samples did not need ethics approvals because the examinations were carried out on beef products purchased from the market (not on living animal).

3.2. Collection of Samples:

A total of sixty randomly chosen samples of beef products (traditional Egyptian beef luncheon, oriental beef sausage and beef burger) were gathered from various stores in Cairo and Giza, Egypt. The products were purchased in the first month of their production period. A sterile container ice box was used for transportation of each sample to the food hygiene depcoartment in Animal Health Research Institute, Dokki, Giza. The samples were examined just after arrival to the laboratory. The collected samples subjected for bacteriological examination (Aerobic bacterial count, Enterobacteriaceae, *E.coli* and *S. aureus*), chemical analysis (fat, protein, moisture, and ash), physicochemical evaluation (TVBN, TBA, and pH), levels of chemical additives (phosphate, sorbic acid, ascorbic acid, benzoic acid, and monosodium glutamate) and color evaluation (redness, yellowness, and lightness)..

3.3 Examination of the Bacteriology:

3.3.1 Samples Preparation

According to [20], 25 g from each sample were accurately measured and homogenized with 225 ml of 0.1% peptone water in a sterile plastic bag within a mixer (400 Lab Mixer, Seward Medical, London, UK) for 30 seconds. Ten-fold series of dilutions were utilized for bacteriological examination.

3.3.2 Aerobic bacterial count

According to [21]**,** using the standard Count of plates Agar inoculated plates for 24 hours at 30°C.

3.3.3 Enterobacteriaceae

According to [22]**,** sterilizing duplicate Petri dishes were filled with two ml of every serial dilution sample that was previously created. Every single plate contains 10–15 ml from violet red bile glucose agar (VRBGA).

3.3.4 *E. coli* counts:

Pre-enrichment:

According to[23]**,** Durham's tubes were inverted and one ml of the original dilution was added to the MacConkey broth tubes. After that, infected tubes were left to culture for 24 hours at 37°C.

Enrichment broth:

A positive MacConkey tube was inoculating via a single ml of another MacConkey broth tube, and the mixture was incubated for 24 hours at 44°C.

Plating media:

Following an autonomous streaking of positive MacConkey broth tubes, the chromogenic selective medium (TBX agar) was left at 44°C for a whole day.

3.3.5. *Staphylococcus aureus* count:

According to [24]**,** Using a sterilized bent glass, a spreader, one ml of each of the previously made serial dilutions placed on the agar plate. Cultivation for a period of 48 hours at 37°C. Assumptive S. aureus count/g was considered, and the former colonies (shiny black colonies).

3.4. Chemical examination:

3.4. Chemical composition:

3.4.1. Determination of Moisture Content:

About (2.7- 3) gm of prepared samples were added in the covered dish after that dried in hot air oven (manufactured by MMM Group, model Verticell and Ser. No. 007151) at 125°C for 2-4 hours till persistent weight. The calculation of the moisture % According to [25]**.**

3.4.2. Determination of Protein Content:

Two grams of prepared sample were digested in kjeldahl digestion (Manufactured by VELP Scientifica, model DK Heating Digester and Ser. No. 251476) and distilled in distillation unit of kjeldahl apparatus (Manufactured by VELP Scientifica, model VELP – UDK 129 and Ser. No. 258985). Then the solution titrated using 0.2M HCl to the end point and the calculation of the protein % According to [25]**.**

3.4.3. Determination of Fat Content by Soxhlet Apparatus:

Five grams of sample were weighted and hydrolyzed with 50 ml hydrochloricacid (4N) by boiling over a small flame for 1 hr. Inserted into the extraction thimble and extracted through extraction apparatus (Soxhlet manufactured by VELP Scientifica, model SER 148 and Ser. No. 279716) with the extraction solvent (petroleum ether 40-60 C°). The calculation of the fat % According to [25]**.**

3.4.4. Determination of ash content:

About (3-5) gm of prepared samples were placed in a dry, clean and weighed crucible and ignited in muffle furnace (manufactured by DAIHAN Scientific company, model FH-14 and Ser. No. 10002491300002) at 550°C. The calculation of the ash % According to [25]**.**

3.5. Physicochemical examination:

3.5.1 Total volatile basic nitrogen (TVBN):

In a 2 L mentel flask, an accurately weighed 10 g homogenized food sample weighed, and 2 gm of MgO was added to 300 ml of water distillation. A distillation step generally takes 20 minutes. Back titration using sulfuric acid 0.1N until the colour turned red. TVBN was calculated as follows: TVBN = $(V_A - V_B)$ 14.01 N (0.1) /g*100. That according to **[26].**

3.5.2 Thiobarbituric Acid (TBA):

The sample of beef products, weighing 10 g each, was combined with 2.5 ml of HCl (4 N) and 97.5 ml of water distillation. Distillation process takes 15 to 20 minutes Pipetted into screw-cap tubes were equal amount of distillate and of 0.02 M of TBA glacial acetic acid, a glass cuvette was employed to assess the test sample's absorption at 538 nm. TBA value mg/kg of sample = absorbance x 7.8. That according to **[26].**

3.5.3 pH values:

In a dry, cleaned beaker,10 g homogenized food sample was weighed, and add 100 ml of carbon-free distilled water.After 30 min, the pH values were measured via the pH meter(Inolab,WTTW Series pH 885,Weilheim,Germany).That according to **[26].**

3.6. Determination of Chemical Additives:

3.6.1. Determination of Phosphate Content:

Following a 30-minute heating period in a boiling water bath with 10 ml of HNO_3 added to the ash sample's, the mixture was cooled and then filtered. 20 ml of colorless filtration were added to the 30 ml color reagent. Then, determined at 430 nm via a spectrophotometer. The phosphate was calculated according to [27]**.**

3.6.2. Determination of Ascorbic Acid:

To 25 ml of filtered (20 gm of ground beef mixed with 85 ml of H_2O), 0.4 ml of acetic-metaphosphoric was added solution and mixed, then 2 ml of 2,6 dichlorophenol indophenol solution was added. If the dye is decolorized (the solution remains grey), indophenol solution is added to the end point at 10 s. The calculation of ascorbic acid according to [25].

3.6.3. Determination of sorbic acid and benzoic acid:

The HPLC apparatus was a content HPLC column, Agilent Series 1188 quaternary gradient pump, contains a reversed-phase, octadecyl (ODC)-treat with silica filter with an inner diameter of 4 mm (Hewlett-Packard, Les Ulis,USA) and lengths of 255, 225 mm for the measurement of sorbic and benzoic acid, respectively. The calculation of sorbic and benzoic acids according to **[28].**

3.6.4. Determination of Mono Sodium Glutamate (MSG):

The HPLC apparatus is characterized by an Agilent Series 1188 quaternary gradient pump, holds a reversed-phase, octadecyl (ODC)-treat with silica filter with an inner diameter of 4 mm (Hewlett-Packard, Les Ulis, USA) [29]**.**

3.7. Colour evaluation:

By using a Chromameter (Japan, model CR, 410 Konica Minolta) we measure the lightness (L*), redness (a*) and yellowness (b*) values [30]**.**

4. Results:

4.1. Bacteriological examination

Table 1 Bacteriological counts (log_{10} CFU/g) of examined traditional Egyptian beef luncheon samples:

	APC	**Enterobacteriaceae**	***E. coli***	***S. aureus***
Minimum	2.40	1.95	1.40	1.23
Maximum	5.94	3.84	3.48	2.48
Mean	4.40	2.86	2.33	2.11
SE	0.37	0.21	0.34	0.19

APC= Aerobic bacterial count, SE: Standard error.

Standard methodology of *bacteriology:* Aerobic bacterial count according to ISO *4833-2* 2013, Enterobacteriaceae according to ISO 21528-2 2017, E-coli according to ISO 16649-2 2001 and S. aureus according to ISO 6888-2 2021.

Table 2 Bacteriological counts (log_{10} CFU/g) of examined oriental sausage samples:

	APC	Enterobacteriaceae	*E. coli*	*S. aureus*
Minimum	4.23	2.60	1.54	2.36
Maximum	6.91	4.11	4.20	2.95
Mean	5.49	3.37	2.71	2.68
SE	0.21	0.17	0.29	0.12

APC= Aerobic bacterial count, SE: Standard error.

Standard methodology of *bacteriology:* Aerobic bacterial count according to ISO *4833-2* 2013, Enterobacteriaceae according to ISO 21528-2 2017, E-coli according to ISO 16649-2 2001 and S. aureus according to ISO 6888-2 2021

Table 3 Bacteriological counts (log_{10} CFU/g) of examined beef burger samples:

	APC	Enterobacteriaceae	*E. coli*	*S. aureus*
Minimum	3.93	2.28	2.18	2.04
Maximum	5.71	3.84	2.49	3.30
Mean	4.71	2.87	2.37	2.50
SE	0.14	0.21	0.07	0.40

APC= Aerobic bacterial count, SE: Standard error.

Standard methodology of *bacteriology:* Aerobic bacterial count according to ISO *4833-2* 2013, Enterobacteriaceae according to ISO 21528-2 2017, *E-coli* according to ISO 16649-2 2001 and *S. aureus* according to ISO 6888-2 2021.

Table 4 The mean of bacteriological counts (log_{10} CFU/g) in different examined samples

	APC	Enterobacteriaceae	*E. coli*	*S. aureus*
Luncheon	4.40 [a]	2.86 [a]	2.33 [a]	2.11 [a]
Sausage	5.49 [b]	3.37 [a]	2.71 [a]	2.68 [a]
Burger	4.71 [a]	2.87 [a]	2.37 [a]	2.50 [a]

[a–b] Means with different superscripts within the same row significantly ($P < 0.05$) different.

APC= Aerobic bacterial count, SE: Standard error.

Standard methodology of *bacteriology:* Aerobic bacterial count according to ISO *4833-2* 2013, Enterobacteriaceae according to ISO 21528-2 2017, E-coli according to ISO 16649-2 2001 and S. aureus according to ISO 6888-2 2021

4.2. Chemical composition and physicochemical examination:

Table 5 Statistical analysis of chemical composition and physicochemical exanimations of the examined traditional Egyptian beef luncheon samples:

	Ash%	Protein%	Moisture%	Fat%	TVBN	TBA	pH
Minimum	2.81	6.41	56.44	6.24	12.60	0.12	3.99
Maximum	3.95	16.34	63.65	14.00	35.00	0.75	6.75
Mean	3.26	11.48	59.68	10.32	18.66	0.47	5.66
SE	0.09	1.04	0.72	0.78	1.75	0.05	0.21

TVBN= total volatile base nitrogen (mg %); TBA= thiobarbituric acid (mg malonaldehyde/kg)

Standard methodology of chemical composition (ash%, protein%, moisture% & fat%) according to AOAC 2016 and physicochemical (TVBN, TBA, pH) according to E. 63-9/ Egyptian Standard2006.

Table 6 Statistical analysis of chemical composition and physicochemical exanimation of the examined oriental sausage samples:

	Ash%	Protein %	Moisture %	Fat%	TVBN	TBA	pH
Minimum	1.64	6.93	50.32	7.12	9.52	0.12	5.42
Maximum	4.09	20.51	65.21	17.11	35.00	8.66	7.04
Mean	3.18	12.00	59.76	10.71	18.71	1.13	6.29
SE	0.20	1.09	1.13	0.99	1.97	0.69	0.16

TVBN= total volatile base nitrogen (mg %); TBA= thiobarbituric acid (mg malonaldehyde/kg)

Standard methodology of chemical composition (ash%, protein%, moisture% & fat%) according to AOAC 2016 and physicochemical (TVBN, TBA, pH) according to E. 63-9/ Egyptian Standard2006.

Table 7 Statistical analysis of chemical composition and physicochemical exanimation of the examined beef burger samples:

	Ash%	Protein %	Moisture %	Fat%	TVBN	TBA	pH
Minimum	3.00	6.91	52.73	6.62	13.16	0.41	5.11
Maximum	5.75	15.70	62.82	13.59	20.30	2.48	7.14
Mean	3.70	12.67	58.74	10.39	16.89	0.75	5.75
SE	0.226	0.732	0.889	0.697	0.667	0.161	0.153

TVBN= total volatile base nitrogen (mg %); TBA= thiobarbituric acid (mg malonaldehyde/kg)

Standard methodology of chemical composition (ash%, protein%, moisture% & fat%) according to AOAC 2016and physicochemical (TVBN, TBA, pH) according to E. 63-9/ Egyptian Standard2006.

Table 8 The mean values of chemical composition and physicochemical exanimation of different examined samples:

	Ash%	Protein %	Moisture%	Fat%	TVBN	TBA	pH
Luncheon	3.26 [a]	11.48 [a]	59.68 [a]	10.32 [a]	18.66 [a]	0.47 [a]	5.66 [a]
Sausage	3.18 [a]	12.00 [a]	59.76 [a]	10.71 [a]	18.71 [a]	1.13 [b]	6.29 [b]
Burger	3.70 [a]	12.67 [a]	58.74 [a]	10.39 [a]	16.89 [a]	0.75 [a]	5.75 [a]

[a–b] Means with different superscripts within the same row significantly ($P< 0.05$) different.

TVBN= total volatile base nitrogen (mg %); TBA= thiobarbituric acid (mg malonaldehyde/kg)

Standard methodology of chemical composition (ash%, protein%, moisture% & fat%) according to AOAC 2016 and physicochemical (TVBN, TBA, pH) according to E. 63-9/ Egyptian Standard2006.

4.3. Chemical additive detection:

Table 9 Statistical analysis of chemical additives in examined traditional Egyptian beef luncheon samples:

	Phosphate ppm	Sorbic acid (ppm)	Ascorbic acid ppm	Benzoic acid ppm	MSG ppm
Minimum	1877.68	47.67	13.33	1238.0	189.20
Maximum	10139.62	135.25	91.98	1900.0	28812.30
Mean	4915.64	79.10	40.99	1569.0	4347.18
SE	629.096	28.142	17.712	331.0	235.416

MSG= Mono sodium Glutamate

N.B. Statistical analysis for positive samples only (negative analysis results not included).

Standard methodology of phosphate according to ISO4485 2021, sorbic & benzoic acid according to AOAC 983.16 1983, ascobic acid according to AOAC 2016 & MSG according to M. Lateef 2012

Table 10 Statistical analysis of chemical additives in examined oriental sausage samples:

	Phosphate ppm	Sorbic acid (ppm)	Ascorbic acid ppm	Benzoic acid ppm	MSG ppm
Minimum	1345.83	20.09	10.66	1835.0	356.58
Maximum	11874.35	105.70	16.00	1963.0	2605.60
Mean	5518.33	61.92	14.65	1899.0	1788.14
SE	976.178	14.765	1.330	64.00	176.362

MSG= Mono sodium Glutamate

N.B. Statistical analysis for positive samples only (negative analysis results not included).

Standard methodology of phosphate according to ISO4485 2021, sorbic & benzoic acid according to AOAC 983.16 1983, ascobic acid according to AOAC 2016 & MSG according to M. Lateef 2012.

Table 11 Statistical analysis of chemical additives in beef burger samples:

	Phosphate ppm	Sorbic acid (ppm)	Ascorbic acid ppm	Benzoic acid ppm	MSG ppm
Minimum	451.66	14.36	10.66	0.00	649.90
Maximum	11874.35	32.67	21.32	0.00	2401.00
Mean	4245.69	20.82	16.88	0.00	1226.75
SE	114.209	2.624	3.202	0.00	144.988

MSG= Mono sodium Glutamate

N.B. Statistical analysis for positive samples only (negative analysis results not included).

Standard methodology of phosphate according to ISO4485 2021, sorbic & benzoic acid according to AOAC 983.16 1983, ascobic acid according to AOAC 2016 & MSG according to M. Lateef 2012.

Table 12 The mean values of chemical additives in different examined samples:

	Phosphate ppm	Sorbic acid (ppm)	Ascorbic acid ppm	Benzoic acid ppm	MSG ppm
Luncheon	4915.64 [a]	79.10 [a]	40.99 [a]	1569.0 [a]	4347.18 [a]
Sausage	5518.33 [a]	61.92 [a]	14.65 [a]	1899.0 [a]	1788.14 [a]
Burger	4245.69 [a]	20.82 [b]	16.88 [a]	0.00 [b]	1226.75 [a]

MSG= Mono sodium Glutamate,N.B. Statistical analysis for positive samples only (negative analysis results not included).

Standard methodology of phosphate according to ISO4485 2021, sorbic & benzoic acid according to AOAC 983.16 1983, ascobic acid according to AOAC 2016 & MSG according to M. Lateef 2012.

[a–b] Means with different superscripts within the same row significantly ($P< 0.05$) different

N.B. Statistical analysis for positive samples only (negative analysis results not included).

4.4. Colour evaluation:

Table 13 Statistical analysis of the colour of the examined traditional Egyptian beef luncheon samples:

	L*	a*	b*
Maximum	59.60	26.40	14.50
Minimum	41.90	20.80	9.70
Mean	54.22	24.58	11.04
SE	1.51	0.434	0.431

SE: Standard error. (L*) lightness, (a*) redness and (b*) yellowness. Standard methodology of colour according to E. B. Ozvura 2016.

Table 14 Statistical analysis of the colour values of the examined oriental sausage samples:

	L*	a*	b*
Maximum	57.30	26.50	13.70
Minimum	50.20	16.90	10.6
Mean	54.75	18.89	11.86
SE	0.62	0.73	0.274

SE: Standard error. (L*) lightness, (a*) redness and (b*) yellowness. Standard methodology of colour according to E. B. Ozvura 2016.

Table 15 Statistical analysis of the colour values of the examined beef burger samples:

	L*	a*	b*
Maximum	58.10	26.40	13.60
Minimum	45.30	21.20	9.90
Mean	49.97	23.05	12.0
SE	1.28	0.404	0.357

SE: Standard error. (L*) lightness, (a*) redness and (b*) yellowness. Standard methodology of colour according to E. B. Ozvura 2016.

5. Discussion:

The grade of the raw materials utilized directly affects the finished product, which is processed meat. Meat producers in Egypt employ frozen meat, which means that the meat is impacted by the freezing process, freezing storage, and freezing thawing prior to processing.The quality, shelf-life, and widespread acceptance of these goods are typically affected by the addition of additional compounds, to be are the physiochemical reactions which take place throughout the freezing process [31]**,** [32] **and** [33] **.**

5.1. Bacteriological Counts:

A. Aerobic Bacterial Count (APC)

The outcomes are presented in tables (1), (2), (3) & (4), the mean values of burger and sausage not exceeded the permissible limit stated by ESS No.1688 (2015) **(10^5) for beef burger** and ESS No. 1972 (2015) **(10^6) for beef sausage** [34] but the mean value of luncheon exceeded the permissible limit **(10^4)** stated by ESS No. 8488 (2021) [35]. The variations in outcomes might be explained by improper handling and disregard for sanitary requirements, either at the production stages where the majority of workers without medical certifications or during the sale of beef products [36] **&** [37].

B. Enterobacteriaceae count

The obtained results in tables (1), (2), (3) & (4), the presence of Enterobacteriaceae in meat products is indicative of microbial proliferation, which could encourage the growth of toxic and pathogenic microorganisms which are a public health risk [7]**.** Therefore, awareness must be given to the importance of sanitation.

C. *E. coli* count

Tables of the results that were obtained (1), (2), (3) & (4), the mean values of E.coli in examined meat product samples exceeded the permissible limit stated by ESS No. 8488/ (2021) that should be absent, 1688/ (2015) (10^2) and 1972/ (2015) (10^2). The *E.coli* is indicated of faults during preparation, handling, storage or service [38].

D. *Staphylococcal aureus* count

The outcomes are presented in tables (1), (2), (3) & (4), the mean values of *S. aureus* in different meat product samples exceeded the permissible limit stated by **ESS No. 8488/ (2021) that should be absent, 1688/ (2015) (10^2) and 1972/ (2015) (10^2).** High *S. aureu*s count in meat products is a personal hygiene contamination during processing, handling and transportation [38]**,** [39]**,** [40] **&** [37].

5.2. Chemical composition:

5.2.1. Moisture:

According to the results in tables (5), (6), (7) and (8), the average value of the samples of meat products did not go beyond the acceptable limit outlined in **ESS Nos. 8488 (2021) (within 60%), 1688 (2015) (within 60%), and 1972 (2015) (within 60%),** respectively. The variations in moisture content may also result from varying material ratios employed during production or from the addition of water, which is utilized to make the mixing and blending of ingredients easier. Accordingly, adding too much water to a product to make it larger constitutes adulteration [41]**.**

5.2.2. Protein content:

Tables of the results that were obtained (5), (6), (7) and (8), the average of the meat product samples is lower than the range allowed by **ESS Nos. 8488 (2021) (within 15%), 1688 (2015) (within 15%), and 1972 (2015) (within 15%),** respectively. Some meat products might lack enough protein because they were prepared with improper cuts of meat, used meat scraps in place of meat, or substituted non-meat ingredients. Because proteins have a great biological value and may provide the body of a human being with all needed and non-essential amino acids, their lack in the studied meat products makes them of low quality [42]**, (**[37]**,** [43] **&** [44]**.**

5.2.3. Fat content:

According to the data found in tables (5), (6), (7) and (8), it was clear from **ESS Nos. 8488 (2021) (within 35%), 1688 (2015) (within 20%) and 1972 (2015) (within 30%)** that luncheon, beef burger and sausage had mean fat% values that were lower than normal limits. According to sensory analysis, lowering the fat level led to lower texture and overall palatability ratings [45]. The protein & fat present in the meat products were attributable to the decreased in red meat content [46]**,** [47] & [43].

5.2.4. Ash content:

Tables of the results that were obtained (5), (6), (7) and (8), According to **ESS 1688 (2015),1972 (2015)**(within 5%)**, respectively.**it was evident that beef burger and sausage were accepted as the mean values of Ash%.There were some traditional Egyptian beef luncheon and beef burger samples that had Ash% levels that were higher than the permitted limit allowed by the Egyptian Standard Specification (**ESS Nos. 8488 2021)** (within 3.5%) [48].This indicated the addition of high carbohydrate and/or large amounts of mechanically recovered poultry meat, which could be linked to high concentration of bone.Because calcium as well as macrominerals,soft bone and other chicken components in the patties may further raise the ash content [49] **,** [50]**.**

5.3. Physicochemical Exanimation:

5.3.1. TBARS, TVBN and pH:

Tables (5), (6), (7) and (8) of the data show that the TVBN, TBA and pH in the beef meat products, according to **ESS No. 8488/ (2021), 1688/ (2015) and 1972/ (2015) (20 mg/100g & 0.9 mg mal/Kg) respectively,** it was evident that luncheon, beef burger and sausage were accepted the mean value of TVBN. The higher TVBN in examined samples may be attributed to break down of protein as a result of microbial activity and proteolysis enzymes [51].The mean value of the TBA of the luncheon and burger samples complied with the permitted limit specified by **ESS Nos. 8488 (2021) and 1688 (2015)**; however, the mean value of the sausage samples was above the allowed limit specified by **ESS No1972/ (2015).** The increase in TBA may have been caused by faster rates of oxidation and proteolysis as well as the generation of Secondary chemicals such biogenic amine and malondialdehyde [52]**,** [53] **&**[31]. Although the pH value is useful for evaluating raw meat, it is not a dependable criterion for value-added products because it might fluctuate negatively or positively depending on the additives used [54]**.**

5.1.2. Chemical additives:

5.1.2.1. Phosphate in Meat Products:

Tables (9), (10), (11) and (12) revealed that of the inspected traditional Egyptian beef luncheon, oriental sausage and beef burger were more than the permitted limit according to **ESS NO. 8488/ (2021), 1972/ (2015) and 1688/ (2015) (0.3%),** respectively **and** according to **Codex (192/2021) (revised, 2023).**Phosphates are necessary for a number of reasons when processing meat and meat products: they also elevate pH, promote muscle protein form, enhance water holding capacity (WHC), maintain beef emulsions, less cooking weight losses, and improve texture and flavour characteristics. All of these factors contribute to elevated yields. In besides prolonging the lifespan of products [10]**,** [55] **and** [56] **.**

On the other side the increases in cardiovascular morbidity and mortality observed in patients receiving chronic dialysis has been caused by excess phosphate [57]**.** The only significant side effects of phosphates in conventional immediate, subchronic, and chronic toxicity investigations are kidney calcification and tubular nephropathy [58] **&** [59]**.**

5.1.2.2. Ascorbic acid in meat products:

Table (12) results showed that ascorbic acid was found in each of the samples that was looked in traditional Egyptian beef luncheon, oriental sausage and beef burger were prescribed on label and this agree with [60] **and** [18] for the consequences of the oriental sausage and beef burger.All the examined samples of traditional Egyptian beef luncheon, oriental sausage and beef burger were recognized according to **ESS NO. 8488/ (2021), 1972/ (2015) and 1688/ (2015) (500 mg/kg)**.

5.1.2.3. Sorbic acid & Benzoic acid in Meat Products:

The results reported in tables (9), (10), (11) and (12) revealed that the sorbic acid & benzoic acid in the evaluated beef product samples, that sorbic acid in beef meat products was accepted according to **Codex (192/2021) (revised, 2023)** but benzoic acid in luncheon & sausage were unaccepted (1569.0 & 1899.0) according to **Codex (192/2021) (revised, 2023)**.The addition of a high percentage of benzoic acid is a result of using low quality of raw materials used by manufacturers. Allergies, hyperactivity and Attention- deficit/hyperactivity disorder (ADHD) were brought on by consumption above the ADI (5 mg kg-1). Furthermore thought to be genotoxic, neurotoxic, and clastogenic, benzoate was also shown to modify the cell cycle and cause a confirmed incorporation in the DNA structure [61].

5.1.2.4. Monosodium Glutamate (MSG) in Meat Products:

Table (12) showed that the mean value of the examined traditional Egyptian beef luncheon, oriental sausage and beef burger were not more than the permitted limit according to **ESS NO. 8488/ (2021), 1972/ (2015) and 1688/ (2015) (5000 mg/kg),** respectively. Foods that contain tiny amounts of monosodium glutamate have higher palatability. As a result, it can be used to improve flavour and known in eastern cooking as the "umami" taste. In addition to the four primary tastes, many scientists think that umami is a fifth flavour. When added to food at amounts over the respective detection threshold, MSG offers it a delectable umami flavour; at smaller doses, it enhances flavour. [55]**.**

To replace the flavour that is lost when fat is decreased or eliminated, low-fat meals employ monosodium glutamate [62]**.** The acceptable daily allowance of glutamic acid was established by the European Food Safety Authority in 2017 as 30 mg.kg-1 of body weight. The quantities that, when taken regularly, can result in symptoms were also made clear by EFSA: an elevation in arterial pressure (> 150 mg.kg-1), headaches (> 85.8 mg.kg-1), a sign of complex (> 42.9 mg.kg-1) and an increase in insulin (> 143 mg.kg-1) [63]**.**

5.5.5. Colour in meat products:

Regarding to data obtained in tables (13), (14), & (15), that are indicated that the colour (L*) lightness, (a*) redness and (b*) yellowness) of meat samples. In this regard, [64] reported that the Lightness (L*) values increased with decreasing the protein content. The redness (a*) value was low to meat products. This may be due to the low concentration of myoglobin pigment [65]**,** this mean that the protein was low concentrated in beef meat products.

Because removing phosphates from meat products may have an increased rate of oxidation (namely, TBARS), which likely led to the colour change that results from the decomposition of meat proteins, the presence of phosphates in meat products produced increased L* and a* while the effect of ascorbate addition (higher a* and b* color parameters) [66]. Given that colour is one of the major visual characteristics that impact consumers' decisions on buying meat, it becomes essential for meat producers to evaluate quality in that regard. [67]**.**

6. Conclusion

The results concluding that the nutritional composition of the traditional Egyptian beef luncheon, oriental sausage and beef burger examined samples lower than the ESS permissible limits in protein and fat lead to low quality of meat products or substituted non-meat ingredients. The microbial counts surpassed ESS permissible limits in traditional Egyptian beef luncheon. The results in oriental sausage and beef burger exceeded ESS permissible limits in E. coli & S. aureus. That results indicated the production and processing of meat products in Cairo Egyptian markets are facing very low hygienic measures and may be also use of bad meat quality and bad additives in addition to bad handling and bad practicing during processing which need more investigation and need immediate intervention to improve the quality of such products. Manufacturers of meat products do not adhere to Egyptian standard specifications therefore this is monitored by various Egyptian control organizations. Random analysis of meat products samples to allow the use of preservatives within the limits of permissible percentages in order to preserve the health of the consumer.

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