



Abstract

A total of 60 random samples of frozen meat products represented by Beef burger, Hawawshi, Kofta, and oriental Sausage (15 of each) were collected from "Bab El Louk" market from different sanitation levels shops at Cairo province. The samples were directly transferred to the laboratory under aseptic condition and examined for sensory evaluation (appearance, odour, texture, over all acceptability), deterioration criteria (pH, TVBN, TBA) and microbiological evaluation (total bacterial count, Psychrotrophic count, total yeast and mould count, Coliforms counts and total staphylococcal count in addition to isolation and identification of Staph. aureus, E.coli and salmonella. Based on sensory attributes score, 56.66% (34 samples) of all examined samples are accepted. TVBN ranged from 16.52 – 20.54 mg% with Hawawshi samples showed the highest value. TBA values of examined samples ranged from 0.52 to 0.69 mg malonaldehyde/ kg with no significance difference could be established among all examined samples. Microbial counts of Beef burger, Hawawshi, Kofta, and Sausage samples exceeded ESS permissible limits. S. aureus and E. coli were isolated from 20% of examined samples, while salmonella could be isolated from Hawawshi (13.33%), Kofta (13.33%), and Sausage (13.33%) and failed to be isolated from beef burger samples. Ready to cook meat products marketed in public market are of high risk and low quality.

Introduction

With the high cost of meat and the demand of a growing population, the technological developments in meat processing has given consumers a much greater choice over the food they can buy (Vernam and Sutherland, 1995).

Ready to Cook meat products such as sausage, Hawawshi, and Kofta are actively replace the highly price fresh meat and still have the same nutritive value and much palatable (Unnevehr, 2015).

Processed meat products may be a cause of public health hazard either due to the presence of spoilage microorganisms responsible for objectionable changes or pathogens through improper handling and storage- leading to infection and intoxication (FAO/WHO, 1983).

Food quality and safety is an increasingly important public health issue. Nowadays, the topics (food quality) and (food safety) are very close and important issues in the food sector, due to the globalization of the food supply and the increased complexity of the food chain (FAO, 2003).

The consumers need to purchase safe products that do not involve any kind of risk for health. On one hand, the aim of the food safety is to avoid health hazards for the consumer, microbiological hazards, pesticide residues, misuse of food additives and contaminants, such as chemicals, biological toxins and adulteration. On the other hand, (food quality) includes all attributed that influence the value of a product for the consumer; this includes negative attributes such as spoilage, contamination with filth, discoloration, off-odours and positive

attributed such as the origin, color, flavor, texture and processing method of the food (FAO, 2003).

With increase consumer awareness by importance of ready to cook food especially most product, more emphasis should be targeted for ensuring the quality and safety of the products. Therefore the present study aim to evaluate the ready to cook meat products marketed in the most public market in Cairo through examination of the sensory, deterioration criteria and microbiological load.

Material and Methods

A total of 60 samples of Beef burger, Hawawshi, Kofta, and oriental sausage (15 samples each) were purchased from "Bab El Louk Market" Cairo – Egypt. The Collected Samples were directly transferred to the laboratory under aseptic condition in ice box, and subjected to sensory analysis, determination of deterioration criteria and microbiological examination.

Investigation

Sensory analysis:

Seven points descriptive scheme of Lattuadaet al, (1998) was used to evaluate appearance, odour, texture and overall acceptability of examined products. Team consists of 9-11 members familiar with meat products characters (from Central Public Health Laboratories (CPHL) - ministry of Health) were forming the panelist team.

Deterioration criteria

pH was measured using pH meter (ORION/KNI PHE EU TECH England) as described by (A.O.A.C, 1991).

The extent of lipid oxidation was assessed by measuring thiobarbituric acid value (TBA- value) using the distillation method described by DU and Ahn, (2002).

TBA value were calculated and expressed as mg mal/kg samples.

--Determination of total volatile base nitrogen (TVB-N mg %): distillation method was performed by using micro distillation unit as described by **Ronald and Ronald (1991)**.

Microbiological examination:

Samples were prepared according to the technique recommended by **ICMSF, (1987)** for the following tests.

Enumeration of total aerobic bacteria(ISO 4833-1:2013): plate count agar (Oxoid CM 463) at incubator at 30°C for 72 hours.

Enumeration of Psychrotrophic bacteria (cousin et al. 1992): Standard plate count agar (Oxoid CM 463). The plates were incubated in at 7°C for 7 days.

Enumeration of Coliforms (ISO4832, 2006): VRBA (Violet red Bile agar) medium (Oxoid CM 107) at 37°C for 24hrs.

Enumeration of Yeast and Mould count (FAO, 1992):

Sabrouds dextrose agar medium (Oxoid CM 41) supplemented with chloramphenicol and chlortetracycline (100mg of each) incubated at 25°C ± 2 after 3 days of incubation. The first examination of the plates was done to the degree of yeast then the mould count was reported on the fifth day.

Enumeration of Staphylococcus Bacteria(ISO 6888-1, 1999):Technique using Baird Parker agar medium (Oxoid CM 275, SR 54) plates were incubated for 48hrs at 35°C.

Isolation and Identification of food borne pathogens:

Escherichia coli (E.coli)(ISO 16649-2, 2001):

TBX (treptone – bile – x glucuronic) medium (Oxoid CM 945) at 44°C for 18-24hrs typical colonies which appeared blue were picked up and transferred to nutrients agar slant and incubated at 37°C for 24hrs for Biochemical tests(**MacFaddin, 2000**) and serological identification according to **Hallmann and Burkhardt, (1974)** at Clinical Microbiology Department, Central public health lab – Ministry of Health on Egypt.

Salmonella(ISO 6579-2002):

Pre enrichment: 225 ml of 1% buffered peptone water (Oxoid CM 509) and incubated at 37 °C for 24 hours.

Selective enrichment:On Rappaport’s Vassiliadis (RVS) broth (Oxoid CM 669) and incubated at 43°C for 24 hours followed by:

Selective plating: Xylse lysine deoxy chocolate agar (XLD)(Oxoid CM 469) and Salmonella Shigella agar (Oxoid CM 99) plates. The plates were incubated at 37°C for 18 hours. Typical colonies were purified on a slope of nutrient agar (Oxoid CM 3) and incubated for 24hours at 37°C for biochemical reaction and serological identification (**Kauffmann, 1974**).

Staphylococcus aureus (FDA, 2001):

Biochemical identification of Staph aureus confirmed by **Coagulase Test(FDA, 2001)**

Statistical analysis:

Each analysis was run in three replicates, and collected data were analyzed using SPSS statistics 17.0 for windows. Results were recorded as mean ± SD. Analysis of variance was performed by ANOVA procedure (one way) and comparison between means were tested by the least significant (LSD) and significance was defined at P<0.05.

Results

Figure(1): Mean values of sensory attributes of examined samples

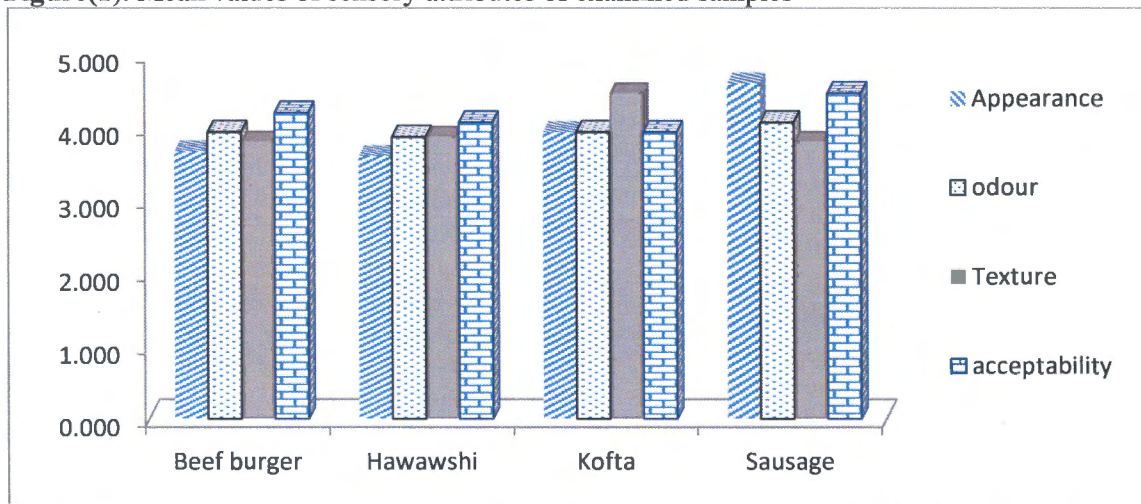


Figure (2): Accepted sample percentage according to thier sensory attributes.

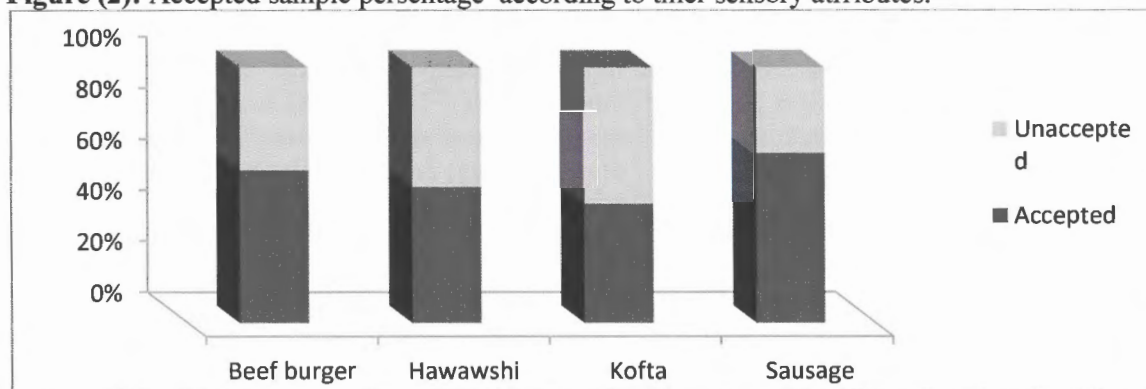


Table (1): Means value of deterioration criteria (PH, TVB-N and TBA) of examined sample

	Beef burger	Hawawshi	Kofta	Sausage
pH	5.873 ^{abs} ±0.179	5.9 ^{abs} ±0.185	5.953 ^b ±0.13	5.927 ^{abs} ±0.171
TVB-N mg %	16.52 ^{acd} ±5.288	20.547 ^{abd} ±4.764	19.52 ^{abd} ±5.247	19.820 ^d ±5.118
TBA mg mal/kg	0.523 ^a ±0.249	0.619 ^a ±0.384	0.693 ^a ±0.354	0.681 ^a ±0.38

(N= 15 for each product)

*means with different letters within the same raw differ significantly at P≤ 0.05

Table (2): Means value of microbiological load (log₁₀cfu/gm) of examined sample

	Beef burger	Hawawshi	Kofta	Sausage
APC	5.749 ^a ±0.456	6.255 ^{bc} ±0.309	5.772 ^{ab} ±1.003	6.265 ^{bc} ±0.694
Psychrotrophes	4.186 ^a ±0.427	4.661 ^{abs} ±0.739	4.229 ^a ±1.132	4.184 ^a ±0.620
Mould	2.525 ^a ±0.321	3.323 ^b ±0.404	3.822 ^a ±0.374	2.898 ^a ±0.305
Yeast	2.576 ^{abc} ±0.385	3.436 ^c ±0.916	2.591 ^{abs} ±0.140	2.493 ^{abc} ±0.342
Staph	2.553 ^a ±0.949	3.171 ^b ±0.797	2.295 ^a ±0.561	2.263 ^a ±0.642
Coliforms	2.920 ^a ±0.537	4.281 ^b ±0.630	4.180 ^b ±0.591	4.112 ^b ±0.745

(N= 15 for each product)

*means with different letters within the same raw differ significantly at P≤ 0.05

Table (3) Isolated Staph.aureusserotype from examined samples

Beef burger		Hawawshi		Kofta		Sausage		Total	
No.	%	No.	%	No.	%	No.	%	No.	%
2	13.33	4	26.68	3	20	3	20	12	20

Table (4) IsolatedE.coliserotype from examined samples

	Beef burger		Hawawshi		Kofta		Sausage		Total Products	
	No.	%	No.	%	No.	%	No.	%	No.	%
O111:K58	-	-	1	6.67	-	-	1	6.67	2	3.33
O119:K69	-	-	1	6.67	1	6.67	-	-	2	3.33
O125:K70	-	-	1	6.67	1	6.67	1	6.67	3	5.00
O127:K61	1	6.67	-	-	-	-	-	-	1	1.66
O26:K60	-	-	-	-	1	6.67	-	-	1	1.66
O44:K74	1	6.67	-	-	-	-	-	-	1	1.66
O55:K99	-	-	-	-	-	-	1	6.67	1	1.66
O88:K61	-	-	1	6.67	-	-	-	-	1	1.66
Total	2	13.33	4	26.68	3	20	3	20	12	20

(N= 15 for each product)

Table (4) IsolatedSalmonellaSerotype from examined samples

Serotype	Beef burger		Hawawshi		Kofta		Sausage		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
SalmonellaEntertidis	-	-	1	6.67	-	-	-	-	1	6.67
Salmonella ParatyphiA	-	-	-	-	1	6.67	1	6.67	2	13.34
SalmonellaTyphi	-	-	1	6.67	1	6.67	1	6.67	3	5
Total	-	-	2	13.34	2	13.34	2	13.34	6	10

Discussion

Meat and meat products are considered as a major vehicle of the most reported food poisoning outbreaks. Therefore, it is important to use these criteria as it gives guidance on the acceptability of meat products and their manufacturing, handling and distribution processes.

According to results showed in figure (1) and (2) which express the means value of sensory evaluation for examined samples (appearance, texture, odour, over all acceptability and percentage of acceptance).

Sensory evaluation showed that 56.66% of all examined samples were accepted according to ESS. Where, Kofta showed that the lowest accepted percentage (46.67%) followed by Hawawshi (53.33%) and beef burger (60%) while sausage showed the highest acceptable percentage (66.67%).

Mean values of pH result of all examined samples are presented in table (1). pH of examined samples ranged from 5.87 to 5.95 with no significance difference $P < 0.5$ among them. This could be attributed to additives used in products to reduce pH toward the acidic side.

TVBN content in examined samples is recorded in table (1). Hawawshi samples showed the highest value (20.6 mg %), while that of sausage (19.8 mg %) and followed by Kofta (19.5 mg %). These values consider as the maximum permissible limit stated in ESS for sausage and Kofta 1972/2005 and 1973/2005 respectively.

These values reflect bad storage condition in addition to high microbiological load of examined samples where their APC is exceeded $6 \log_{10} \text{cfu/g}$ for Hawawshi and Sausage and over $5 \log_{10} \text{cfu/g}$ for Kofta.

On the other hand, TVBN of beef burger was (6.5 mg %) where within acceptable limit (20 mg %) of ESS.

It is worth to mention that no significance difference could be established among examined samples.

TBA values of examined samples are recorded in table (1). No significance difference could be established among all examined samples, it ranged from 0.52 to 0.69 mg malonaldehyde/ kg.

The high value of TBA recorded in examined samples indicate high fat content in these product and bad storage condition, also low fat quality may be used.

Microbiological evaluation

Microbiological counts of beef burger, Hawawshi, Kofta, and sausage are mentioned in table (2). The highest microbial counts were recorded for

Hawawshi while the lowest counts are recorded for beef burger. Hawawshi and sausage samples showed probably count that exceed permissible limit of ESS (1972/2005) while aerobic plate count for beef burger and Kofta were within permissible limit ($5.75 \log_{10} \text{cfu/g}$, $6.26 \log_{10} \text{cfu/g}$) respectively, however they were presented in the upper limit of ESS standard.

Beef burger showed significant reduction in aerobic plate count then, Hawawshi and sausage while no significant difference could be noticed among the other samples.

The total aerobic bacterial count of any food articles is not only a sure indicator of its safety for consumption, yet it is of importance in judging the hygiene conditions under which it has been handled (Saad, 1976). Also the presence of numerous mesophilic bacteria which grow successfully at or near body temperature would stimulate the multiplication of microorganisms (Gill et al, 2000).

No significance difference could be noticed among all examined samples for their psychrotrophic bacterial count, however, all samples showed high Psychrotrophic bacterial count were beef burger ($4.18 \log_{10} \text{cfu/g}$), Hawawshi ($4.66 \log_{10} \text{cfu/g}$), Kofta ($4.23 \log_{10} \text{cfu/g}$), and sausage ($4.18 \log_{10} \text{cfu/g}$). Which may facilitate their spoilage and short shelf life also, it explain their bad sensory score recorded for all examined samples.

Psychrotrophic bacteria are the main cause of spoilage of meat products which are kept under refrigeration temperature due to their ability to grow at low temperature. Total Psychrotrophic bacterial count can provide useful information about keeping quality of meat products (Mousa et al, 2014).

Yeast and Mould counts of all examined samples of Beef burger, Hawawshi, Kofta, and Sausage were exceeded the permissible limit stated by ESS (1688-/2005, 1973/2005 and 1972/2005).

Yeasts and Moulds are used as an index for the proper sanitation and high quality products (Shaltout, 1996).

The high Yeast and Mould count is an index for improper sanitation during processing of Beef burger, Hawawshi, Kofta, and Sausage. At the same time, mould can assist in putrefaction and may impart mouldy odour and taste to this products also, and some mould can produce harmful mycotoxins (Frazier and Westhoff, 1982). Yeast play a little role in spoilage process as they grow slowly in comparison to bacteria or mould but they may find the chance of growth in food and

resulting in undesirable physical changes (Jesenska and Hrdinova, 1981).

Staphylococci count in beef burger, Kofta and sausage proved lower count ranged from 2.26 to 2.55 log₁₀cfu/g with higher significant count in hawawshi reached to 3.17 log₁₀cfu/g. However, 20% of all examined samples were positive for Staphylococcus recorded in table(3). Hawawshi samples are the most contaminated with Staphylococcus than other examined samples.

Staphylococci are found on skin and in nose and throat of most people as well as infected wounds, pimples and boils are generally rich sources.

High staphylococcal count in meat products is a hygienic significance of high contamination during processing, handling, and transportation (FDA, 2005). So, when Staphylococci get into raw warm food can multiply and produce toxin that not affected by heat treatment during further processing and can cause food intoxication.

The high incidence of Staph aureus may be due to very bad hygienic measures in many supermarkets (Hayes, 1992).

Coliforms count is exceed for log₁₀cfu/g in Hawawshi, Kofta and Sausage with significance lower count recorded in Beef burger samples (2.92 log₁₀cfu/g) than other examined samples. Hawawshi, Kofta, and Sausage samples double exceed the permissible limit according to ESS (1973/2005), (1972/2005) respectively while for Beef burger only one exceeds the permissible limit of ESS (1688/2005).

Coliforms are a group of organisms and use as hygiene indicator organisms. The presence of Coliforms in meat and meat products indicate a potable fecal source of contamination which begin from slaughterhouse as a result of skinning of animals by knives and workers, also evisceration. Contamination may come from animal intestine, air and water used for washing and rinsing carcasses. Also, the plant itself may be due to difference in manufacture practice, handling from producers to consumers and effectiveness of hygienic measures applied during production. (Gaafer, 2009)

In addition 20% of examined samples (12 samples) proved presence of E.coli. Where, burger is contaminated with O127:K61 and O44:K74. While Hawawshi is contaminated with O111:K58, O119:K69, O125:K70, and O88:K61 (one for each serotype). O119:K69, O125:K70 and O26:K60 were isolated from Kofta samples (one for each serotype). Sausage is contaminated by O111:K58,

O125:K70, and O111:K58 (one for each serotype) as showed in table (4).

E.coli associated with sewage contamination of foods, water and personal hygiene, the bacteria themselves can cause food poisoning or they can produce poison in the gut (Eglandsdaletal,2007).

This result highlighted the role that might be played by meat in transmission of E.coli that could constitute public hazard specially it was reported that E.coli was implicated in case of gastroenteritis, cystitis, pyelonephritis, peritonitis and food poisoning outbreaks (Doyle, 1991)

Isolated salmonella serotypes from beef burger, Hawawshi, and sausage were shown in table (5). Salmonella couldn't be isolated from beef burger examined samples. On the other hand, 13.33% of examined Hawawshi and sausage samples were contaminated with different serotypes of Salmonella, where SalmonellaEnteritidis is isolated from Hawawshi with 6.67%, while SalmonellaTyphiwere isolated 6.67% from Hawawshi, Kofta, and sausage (one for each product) and Salmonella Paratyphiwere isolated from 6.67% from Kofta and sausage only.

The higher rate of salmonella isolation showed hit the alarm bell as salmonellosis infection in man that was characterized by clinical symptoms including gastroenteritis, typhoid and cholera like syndrome in adults and symptoms of dyspepsia, enterocolitis and typhoid fever in children and these symptoms where often accompanied by septicemia and bacteremia that may threaten human life (Pyakin, 1976).

Conclusion

The results obtained from this study can be conclude that burger, Hawawshi, Kofta, and orientalsausage processed and produced in the local market Bab El Louk have low sensory attributes scores with marginal line deterioration criteria for TBA and TVBN. Also microbial counts could be found in all products that exceed the ESS standard for these products. Also, Staph.aureus, E.coli, and Salmonellaare isolated with 20%, 20% and 10% respectively. These results indicate that the production and processing of ready to cook meat products in Bab El Louk market are facing very low hygienic measures and may be also use of low meat quality and low 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.

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الملخص العربي

سلامة وجودة منتجات اللحوم المعدة للطهي المباعة في سوق باب اللوق- القاهرة - مصر

سارة سمير* - جيهان قاسم** - نبيل يس**

الإدارة المركزية للمعامل وزارة الصحة* - قسم الرقابة الصحية علي الاغذية- كلية الطب البيطري - جامعة القاهرة**

تم جمع عدد ٦٠ عينة عشوائية من منتجات اللحوم المجمدة التي يمثلها برجر لحم، حواوشي، كفتة، والسجق الشرقي بواقع (١٥ لكل منهما) من سوق "باب اللوق"، من محلات تختلف مستويات اتباعها للشروط الصحية في محافظة القاهرة. تم نقل العينات مباشرة إلى المختبر في وحدة تبريد في بيئة معقمة وفحصها للتقييم الحسي (المظهر والرائحة والملمس، مدي القبول)، ودلالات الفساد (الاس الهيدروجيني، المركبات النيتروجينية الطيارة، وحمض الثايوبريبايتيورك) والفحص الميكروبيولوجي (العدد الكلي للبكتيريا، العدد الكلي للبكتيريا المحبة للبرودة، والعدد الكلي للخمائر والفطريات، العدد الكلي لبكتيريا المجموعة القولونية والعدد الكلي للبكتيريا العنقودية بالإضافة إلى عزاللبكتيريا العنقودية الذهبية، ميكروب القولون النموذجي والسالمونيلا وقد اظهر الفحص الحسي بأن ٥٦.٦٦٪ (٣٤ عينة) مقبولة حسياً و تراوحت المركبات النيتروجينية الطيارة ١٦.٥٢ - ٢٠.٥٤ ملليجرام/١٠٠٪ مع ملاحظة ان عينات الحواوشي كانت الأعلى قيمة. وتراوحت قيمحمض الثايوبريبايتيورك فيالعينات السفحوصة ٠.٥٢-٠.٦٩، ملجم مالونالدهيد/ كجم مع عدم وجود أي فرق واضح بين جميع العينات التي تم فحصها. اظهر الفحص الميكروبيولوجيان عيناتالبرجر ، الحواوشي، الكفتة، والسجق تجاوزت الحدود المسموح بهاوفق المواصفات القياسية المصرية (٢٠٠٥/١٦٨٨، ٢٠٠٥/١٩٧٣، ٢٠٠٥/١٩٧٢) على الترتيب.تم عزل البكتيريا العنقودية الذهبيةوباسيل القولون النموذجيينسبة ٢٠٪ من اجماليالعينات المفحوصة، في حين تم عزل ميكروب السالمونيلا من عينات الحواوشي بنسبة (١٣.٣٣٪) والكفتة بنسبة (١٣.٣٣٪) والسجق بنسبة (١٣.٣٣٪)، ولم يتم عزلميكروب السالمونيلا في عينات البرجر. وقد خلصت الدراسة بان منتجات اللحوم المجهزة للطهيالمباعة في الاسواق الشعبية ذات مخاطر عالية، وجودة منخفضة.