

MICROBIOLOGICAL AND CHEMICAL PROPERTIES IN CHICKEN PRODUCTS COLLECTED FROM LOCAL MARKETS.

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ABSTRACT

The aim of the present work is to determine the physical, chemical properties and some pathogenic densities include psychrophilic, mesophilic, *Staphylococcus aureus*, *Clostridia spp*, *Salmonella spp*, *Shigella Spp.*, *Compylobacter spp*, total coliform and *L. monocytogenes* in some chicken products purchased from local markets in Cairo city. The results showed that the protein percentage ranged from 15.2% to 15.6% in burger, 13.3% to 13.4% in nuggets, 13.45% to 16.3% in kofta, 11.3% to 14% in luncheon and 13.5% to 14.96% in sausage. Thiobarbituric acid (TBA) mg/ 100g ranged from 0 to 2.69 mg/ 100g in luncheon, sausage, burger, kofta and nuggets.

Microbiological counts showed that all the examined samples ranged from 88×10^4 to 15×10^7 in aerobic bacterial count. All the examined samples were accepted with Egyptian Standard method for psychrophilic bacteria, mesophilic bacteria, *Staph. aureus* and clostridia except sausage samples collected from Nasr City for *Staph aureus*. Also for kofta and nuggets exception was in mesophilic for samples collected from Shubra, Nasr City and Down Town. However, all the samples are free from *Salmonella*, *Shigella* and *E. coli* except the samples collected from Shubra and Down Town. For the campylobacter, in Shubra, it was found in 66.5 and 33.5% for burger and nuggets, respectively. In Down Town, it was found in 33.5, 66.5, 66.5 and 33.5% for burger nuggets, kofta and luncheon.

INTRODUCTION

Chicken and chicken meat products are consumed in all countries, and they are known as good sources of animal protein of high biological value, besides, it contains a lot of minerals as potassium, iron, phosphorus, magnesium, calcium, sodium, iodine, sulfur, chlorine and traces of vitamins (Mounteny, 1966).

Since chicken meat products are considered as a new developing food industry in Egypt, there are few information and data available concerning their microflora or their level of bacterial contamination in retail market. Many types of microorganisms are present in chicken products as a result of contamination from feather, fat and intestinal contents of slaughtered birds. Equipment and personal on processing lines may play an important role in spreading bacteria. The bacterial flora may be a significant factor causing spoilage or may represent a public health hazard unless by proper sanitation and cooking (Kraft, 1971).

The fitness of any food product should be based on combined information obtained from chemical, bacteriological and organoleptic evaluation which includes smell, appearance and texture (Libby, 1975).

Quantifying the total microbial population is an excellent indicator of contamination, which has already taken place during processing and is a useful tool for predicting a product shelf life (Samah and Saleh, 1997).

The objectives of the present study are to determine the following: physical and chemical properties of chicken products, total microbial densities, psychrophilics, mesophilics, *Staphylococcus aureus*, *Clostridia sp*, *Salmonella*, *Shigella* and *Campylobacter*, total coliform and faecal coliform (as an indicator for the presence of pathogenic microbes) in chicken products.

MATERIALS AND METHODS

Two hundred samples of chicken products including chicken kofta, chicken burger, chicken sausage, chicken luncheon and chicken nuggets were collected from different Cairo retail market (Shubra, Nasr City and Down Town). Samples were collected in ice box and taking notes about the sample, (date of collection, production date, expire data, source, color, odor, texture... etc). The samples were transported immediately to the laboratory for the study of the microbiological and chemical quality.

Incidence of pathogenic bacteria in chicken products

Isolation of *Salmonella*, was carried out according to Ellis et al (1976). The suspected colonies were subcultured on nutrient slope agar and incubated at 37°C for 24hr.

Isolation of *Shigella*, was carried out according to Ellis et al (1976). *Shigella* colonies are red on S.S. agar, *shigella* gives translucent small colonies.

Isolation of *E. coli*, was carried out according to Collins et al (1998).

Salmonella, *shigella* and *E. coli* Identification attempts were made using the criteria described by Kreig & Holt (1984) using the following tests: growth on TSI, urea, indole, M.R.V.P and sugar fermentation. Serological tests of the suspected salmonella strain was carried out according to Kauffmann (1973).

Isolation of *Staph. aureus*: The densities of *Staph. aureus* were determined on Vogel Johnson agar medium (Gouda Hanan, 2002). Biochemical confirmation of *Staph. Aureus*, Representative colonies on a suitable plate were transferred to nutrient agar slants and the cultures were examined through the following tests, Gram staining, and non-spore forming cells, Catalase test was done according to Bailey and Scott (1962) and coagulase production test using technique according to Morrison et al (1962).

Isolation of *Campylobacter*, It was carried out according to Oosterom et al (1983)

Determination of total microbial densities in chicken products was carried out according to Berrang *et al.* (2001).

Clostridia counts, was carried out according to Gouda Hanan, (2002).

Organoleptic properties were done by using boiling and roasting test according to Gracey and Collins (1992).

Crude protein was determined by kjeldahl automatic method using kjel. Tec automatic (16210) analyzer seweden as described in A.O.A.C (2002).

Moisture content was determined at 105°C until a constant weight according to the method described in the A.O.A.C. (2002) Ash content was described as in the A.O.A.C. (2002)

Fat content was determined according to the method described in AOAC (2002).

Thiobarbituric acid (TBA), was determined according to Tarladgis *et al.*, (1960).

RESULTS AND DISCUSSION

1- Physical properties:

A spoiled food is simply a food that is unacceptable to consumer for reasons of smell, taste, appearance, texture or the presence of foreign bodies.

Perceptible changes in odours or flavours in the food occur well when the level of organisms reach $10^6/g$ or per ml or per cm^2 of food surface.

Colour examination (faint pink, reddish, brown, yellowish white) were tested in chicken products (burger, nuggets, kofta, luncheon, sausage) collected from Cairo market (Shubra, Down Town and Nasr City).

The data recorded in Table (1) clearly show that the faint pink colour in chicken products was recorded in burger samples as a rate of 100, 66.5 and 66.5 respectively, in nuggets samples at rates of 66.5 , 66.5 and 100%, respectively, and in sausage samples recorded at 66.5, 66.5 and 66.5%, respectively.

The faint colour of chicken Kofta was the predominating colour and may be related to the state of freshness due to the retention of myoglobin (Miller, 1958) or may be attributed to the addition of excessive amount of fat, fibrous tissues or food additives as soybean (Hefnawy, 1980 and Ibrahim, 1981).

Nearly similar results were obtained by El-Taher (1998) who revealed that faint pink colour of examined chicken products (Kofta, burger and sausage) was observed in 90%, 100% and 80% of the samples respectively. Also Gab-Allah (1990) found that faint pink was predominant in case of burger (60%) and Gab-Allah (1995) also observed that pink colour was predominant in case of minced meat and sausage being present in 60 and 40% of the samples respectively.

The reddish colour in chicken products predominated in 100, 100, 66.5% of luncheon samples respectively. These results were also recorded by Gab-Allah (1990) who found that the reddish colour was the most observed in case of Luncheon (60%) while El-Morsi (1998) revealed that reddish colour was in 56% in Luncheon samples.

Table (1): Percentage of chicken products showing colour changes collected from Cairo retail markets.

Product color%	Shubra			Down Town			Nasr City							
	Burger	Nuggets	Kofta	Sausage	Burger	Nuggets	Kofta	Luncheon	Sausage	Burger	Nuggets	Kofta	Luncheon	Sausage
Faint pink	100	66.5	100	0	66.5	66.5	66.5	0	66.5	66.5	100	100	0	66.5
Reddish	0	0	0	100	33.5	0	0	100	33.5	0	0	0	66.5	33.5
Brown	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Yellowish-white	0	33.5	0	0	33.5	33.5	33.5	0	0	3.5	0	0	33.5	0

Table (2): Average of chemical constituents in burger, nuggets, Kofta, luncheon and sausage samples collected from local markets.

Product	Shubra			Down Town			Nasr City							
	Burger	Nuggets	Kofta	Sausage	Burger	Nuggets	Kofta	Luncheon	Sausage	Burger	Nuggets	Kofta	Luncheon	Sausage
Protein%	15.2	13.4	13.73	11.3	13.5	15.6	16.3	13.56	14.96	14.5	15.86	14.9	13.96	13.83
Fat%	13.61	6.08	15.2	4.33	8.93	15.37	15.81	5.42	7.18	13.83	8.02	18.04	5.41	9.81
Moisture%	66.32	61.3	62.03	60.37	60.2	60.36	58.6	63.5	61.86	54.8	59.04	51.98	64.16	60.6
Ash%	1.85	2.12	3.42	5.37	3.46	2.06	2.03	3.23	6.4	2.20	2.50	4.20	4.66	5.5
TBA mg/100g	0.13	0.22	0.42	0	0.01	0.41	0.17	1.6	0.01	0.69	2.69	0.16	0.02	0

According to the Egyptian standards (1995)

Fat: No increased than 15%

Moisture: No increased than 70%

Ash: No increased than 2.5%

Protein: No decreased than 12%

TBA (Thiobarbituric acid): No increased than 0.9 mg/ 100g

2 - Chemical analysis of chicken products:

Microorganisms are capable of producing a wide range of chemicals associated with their metabolic activities (metabolic byproducts) in food giving odours and flavours that are unacceptable or highly objectionable to the consumer (off odours and flavours).

The major chemical components (protein, fat, moisture, ash and thiobarbituric acid (TBA) were determined in chicken products (burger, nuggets, Kofta, Luncheon and sausage) collected from different area in Cairo markets i.e. The obtained data recorded in Table (2)

Protein percentage ranged from 15.2 to 15.6 in burger, 13.4 to 15.86 in nuggets, 13.73 to 16.3 in Kofta, 11.3 to 14 in Luncheon and 13.5 to 14.96 in sausage.

Fat percentage ranged from 13.61 to 15.37 in burger, 5.83 to 8.02 in nuggets, 15.2 to 18.04 in Kofta, 4.33 to 5.42 in Luncheon and 7.18 to 9.81 in sausage.

Thiobarbituric acid (TBA) values (mg/100g) ranged from 0.13 to 0.69 in burger, 0.17 to 2.69 in nuggets, 0.16 to 1.6 in Kofta, 0 to 0.02 in luncheon and 0 to 0.06 in sausage. Nearly similar results were obtained by Beebe et al., (1989); Mohamed (2000); Ahmed (2002) and conchillo et al., (2003).

The moisture content, ash content and thiobarbituric acid (TBA) values were agreed with Egyptian standards (1995), in burger, nuggets, Kofta, Luncheon and sausage.

3- Microbiological counts:

The data presented in Table (3) show that total aerobic count in burger, nuggets, kofta, luncheon and sausage ranged from 15×10^5 to 34×10^6 , 14×10^5 to 47×10^6 , 43×10^5 to 15×10^7 , 91×10^5 to 8×10^7 and 88×10^4 to 66×10^5 cfu/g respectively. In this study estimation of aerobic plate count was the performance parameter in evaluation of the sanitary condition during manufacturing and handling processes even if there no pathogenic organisms (Thatcher and Clark, 1968). All the examined samples were accepted with Egyptian standards (1995) for psychrophilic, mesophilic, *Staph. aureus* and Clostridia, except the sausage samples collected from Nasr City for *Staph aureus*. Also for Kofta and nuggets there were exception in mesophilic for samples collected from Shubra, Nasr City and Down Town.

The obtained results agreed with those of Refae (1988) and Gab-Alah (1990) who recorded total count of 20.3×10^6 , 14.52×10^5 , 38×10^5 , 17.2×10^5 and 4.42×10^5 and mean *Staph aureus* count of 5.56×10^3 , 4.52×10^3 , 2.7×10^3 , 5.51×10^3 and 5.02×10^3 cfu / g. for minced meat, sausage, burger, Luncheon and kababe, respectively. Osman (2001) recorded total count of 4.1×10^5 , 2.4×10^6 , 1.8×10^6 , 1.4×10^6 and 1.8×10^6 cfu / g. for nuggets, luncheon, sausage, burger and minced meat, respectively.

The results presented in Table (4) show evident incidence of pathogenic bacteria in chicken products.

Table (3): Average microbial load in chicken products collected from Cairo retail markets.

Area	Shubra				Down Town				Nasr City						
	Burger	Nuggets	Kofta	Luncheon	Sausage	Burger	Nuggets	Kofta	Luncheon	Sausage	Burger	Nuggets	Kofta	Luncheon	Sausage
Count (cfu/g)															
Total aerobic	1.7x10 ³	3.2x10 ³	4.3x10 ³	9.1x10 ³	1.5x10 ³	6x10 ³	1.4x10 ³	1.5x10 ³	8x10 ³	6.6x10 ³	3.4x10 ³	4.7x10 ³	2.5x10 ³	1.2x10 ³	8.8x10 ³
Psychrophilic	2.7x10 ⁴	3.3x10 ³	8x10 ³	0	0	1.9x10 ³	8x10 ³	0	0	0	4.1x10 ³	1.95x10 ³	0	0	1x10 ³
Mesophilic	5x10 ³	8.3x10 ⁴	4.9x10 ³	1.6x10 ⁵	1.4x10 ⁴	2x10 ³	7.7x10 ³	5.8x10 ³	1.2x10 ⁶	2.7x10 ³	8.7x10 ³	2.4x10 ³	2.5x10 ³	1.0x10 ⁵	5.1x10 ⁴
Staphylococcus aureus	<10	0	0	0	0	0	0	0	4x10 ⁴	0	0	0	0	0	8x10 ²
Clostridia	<10	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Faecal coliform	<10	0	0	0	1x10 ³	1.5x10 ³	0	1.3x10 ³	6.2x10 ³	4x10 ²	2.5x10 ³	6.6x10 ³	8x10 ²	0	3.7x10 ⁴
Total coliform	1.7x10 ³	0	0	0	3x10 ⁴	1.9x10 ⁴	0	3.6x10 ³	1.7x10 ³	2x10 ³	3.6x10 ³	9x10 ³	1.3x10 ⁴	0	6.4x10 ⁴

Table (4): Incidence of pathogenic bacteria in chicken products collected from Cairo retail markets (%).

Area	Shubra				Down Town				Nasr City						
	Burger	Nuggets	Kofta	Luncheon	Sausage	Burger	Nuggets	Kofta	Luncheon	Sausage	Burger	Nuggets	Kofta	Luncheon	Sausage
Salmonella	0	0	0	0	33.5	33.5	0	0	0	0	0	0	0	0	0
Shigella	0	0	0	0	0	0	0	0	33.5	0	0	0	0	0	0
E.coli	33.5	0	0	0	0	0	33.5	0	33.5	0	0	0	0	0	0
Staph. aureus	0	33.5	0	0	66.5	33.5	0	0	100	0	0	0	66.5	33.5	66.5
Campylo-bacter	66.5	33.5	0	0	0	33.5	66.5	66.5	33.5	0	66.5	33.5	0	33.5	0
L.monocytogenes	33.5	66.2	100	0	0	33.5	66.0	100	0	0	66.5	66.5	100	0	33.5

According to the Egyptian Standards (1995)

Salmonella: No detected E. coli: No detected

Shigella: No detected

L. monocytogenes: No detected

Compyobacter: No detected

All examined samples were free from salmonella, shigella and *E.coli* except some samples collected from Shubra and Down Town such as sausage, Burger, Nuggets and Luncheon which 33.5, 33.5, 33.5 and 33.5% of them were contaminated, respectively. In case of Staph. Aureus it was appeared in nuggets and sausage in 33.5 and 66.5% in Shubra. In Down Town, it was found in 33.5 and 100% in burger and luncheon, respectively. However in Nasr City it was found in Kofta, luncheon and sausage at rates of 66.5 , 33.5 and 66.5% respectively.

For campylobacter, in Shubra, it was found in 66.5 and 33.5% for burger and nuggets, respectively. In Down Town, it was found in 33.5, 66.5, 66.5 and 33.5% for burger, nuggets, Kofta and luncheon, respectively. However, in Nasr City, it was found in 66.5, 33.5 and 33.5% for burger, nuggets and luncheon, respectively.

In case of *L. monocytogenes*, in Shubra, it was found in 33.5 , 66.5 and 100% for burger, nuggets and kofta, respectively. In Down Town, it was found in 33.5, 66.5 and 100% for burger, nuggets and Kofta, respectively. In Nasr City, it was found in 66.5, 66.5, 100 and 33.5% for burger, nuggets, Kofta and sausage, respectively.

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الصفات الميكروبيولوجية والكيميائية في مصنعات الدواجن المجمعة من الأسواق المصرية

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يهدف هذا البحث إلى تقدير الصفات الفيزيائية والكيميائية وبعض كثافة البكتريا الممرضة في بعض مصنعات الدواجن المجمعة من بعض أحياء القاهرة متضمنة البكتريا المحبة للحرارة المنخفضة والمحبة لحرارة المتوسطة والاستيفيلوكوكس اوريس والكلوستيريديا والسالمونيلا والشيجلا والكامبيلوباكتريا والميكروبات القولونية والليستيريا مونوسيتوجينيس .

أظهرت النتائج المتحصل عليها أن نسبة البروتين تتراوح من ١٥,٢% إلى ١٥,٦% في البرجر، ١٣,٣% إلى ١٣,٤% في الناجنس ، ١٣,٤٥% إلى ١٦,٣% في الكفتة و ١١,٣% إلى ١٤% في اللنشون و ١٣,٥% إلى ١٤,٩٦% في السجق ونسبة حامض الثيوباربيتيوريك (بالمليجرام /١٠٠ جرام) تتراوح من صفر إلى ٢,٦٩ في اللنشون والسجق والبرجر والكفتة والناجنس.

أظهرت النتائج الميكروبيولوجية أن أعداد البكتريا الكلية الهوائية تتراوح بين 10×10^8 إلى $10^5 \times$ في جميع العينات المختبرة وقد وجد أن جميع العينات المختبرة كانت مقبولة وفقاً للمواصفات القياسية للبكتريا المحبة للحرارة المنخفضة والمحبة للحرارة المتوسطة والاستيفيلوكوكس اوريس والكوليسنبرديا فيما عدا عينات السجق المجمعة من مدينة نصر. هذا بالإضافة إلى أن عينات الكفتة والناجنس المجمعة من شبرا ومدينة نصر ووسط المدينة كانت مقبولة من حيث البكتريا المحبة للحرارة المتوسطة. ووجد أن جميع العينات كان خالية من السلمونيلا والشيجلا والميكروب القولوني فيما عدا العينات المجمعة من شبرا ووسط المدينة. وقد وجد أن ميكروب الكامبيلوباكتريا في العينات المجمعة من شبرا كان بنسبة ٦٦,٥% و ٣٣,٥% في البرجر والناجنس على التوالي. وفي عينات وسط المدينة تواجد بنسبة ٣٣,٥% و ٦٦,٥% و ٦٦,٥% في عينات البرجر والناجنس والكفتة والنشون على التوالي.