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THE SAFETY AND QUALITY OF FROZEN POULTRY AT AL- HASSA SUPERMARKETS.

الباحثـ ـ ـ ـ ون
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شوال١٤٢٤ هـ

THE SAFETY AND QUALITY OF FROZEN POULTRY AT AL- HASSA SUPERMARKETS.

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ABSTRACT

Frozen chickens (360 samples) of economical importance were collected from Al-Hassa supermarkets, represented to twelve companies; 7 of them locally produced frozen chickens and the others were imported companies. To evaluate the hygiene and safety quality of frozen chickens. Total psychrotrophic aerobic bacteria, *Enterobacteriaceae*, *Salmonella* Spp and serotypes, *Staphylococcus aureus* and pH were determined. Results revealed that the mean values of total psychrotrophic aerobic bacteria on locally produced and imported frozen chickens were 3.92 and 2.80 $\log_{10}$ CFU/cm^2, respectively. The numbers of *Enterobacteriaceae* and *Staphylococcus aureus* on the imported frozen chickens were significantlly lower than that of the locally produced one. The pH values of frozen chickens breast ranged from 5.79 for imported to 5.90 for locally produced, the differences were significant. A total of 360 frozen chickens were analyzed and revealed the presence of *Salmonella* Spp. in 20% (72/360). Eight different serotypes isolated; *S. typhimurium* was predominant 27.78%, followed by *S. hadar* 26.39%; *S. enteritidis* 16.66%, *S. virchow* 15.28%; *S. heidelberg* 5.55%; *S. infantis* 4.17%; *S. cerro* 2.78% and *S. anatum* 1.39%. The hygiene quality of imported frozen chickens was signaficantly higher than that of the locally produced one. The authors stress on the importance of good hygiene practice and risk analysis at the broiler processing plants.

INTRODUCTION

Poultry is a food that has been highly appreciated by man since time immemorial. It is rich in nutrients, some of which are hard to obtain from other food source. This has made poultry meat an important item on our daily menu (Van Logtestijin, 1987).

To day the poultry meat industry has become the predominant source of protein from meat in the diet of the population of most developed countries (Robert, 1990).

During conventional slaughter procedures and further processing to prepare poultry and meats for consumption, microorganisms are introduced into and onto carcasses (Holder *et al.*, 1997). Prevention of contamination during slaughtering and subsequent processing has therefore been identified as by far the most important factor in safeguarding the microbiological quality of poultry (Nursey, 1997; Hogue *et al.*, 1998).

In many countries, poultry meat products continue to be a major cause of human enteritis (Carraminana *et al.*, 1997; Zivkovic *et al.*, 1997; Hung and Tollefson, 1998) and outbreaks are reported regularly involving *Salmonella* Spp and *Staphylococcus aureus* (Antonnette, 1991; Nagy *et al.*, 1997; Headrick and Tollefson, 1998). *Salmonella* and *Staphylococcus aureus* are the most common food poisoning bacteria associated with refrigerated poultry (Gray *et al.*, 1984; Cohen, 1996).

Safety of poultry products is the issue that likely will be the most persistent and costly to combat during this decade. Microbiological safety of poultry products will be questioned repeatedly during this decade, and the intensity of questioning will likely grow as time goes on (Mulder, 1997; NACMCF, 1997; Hogue *et al.*, 1998).

The present study aimed to evaluate the hygienic quality of locally produced and imported frozen poultry at Al-Hassa supermarkets, Kingdom of Saudi Arabia.

MATERIALS AND METHODS

Locally produced and imported frozen chickens (360 chicken weighed 1-1.3 kg each) were purchased from Al-Hassa supermarkets, Kingdom of Saudi Arabia. These frozen chickens were produced by 12 companies (7 local companies and the other were imported companies).At the time of sampling , 30 ckicken for each company were immediately placed in an ice-box and transported to the laboratory within 1 hour. Chickens were allowed to thaw at 4°C for 16 hrs.

Microbiological analysis:

Preparation of samples:

Chickens breast were sampled aseptically by means of excision of surface areas of 15 cm^2 of skin (Russell *et al.*, 1997). A piece of sterile filter paper and skin were homogenized for 2 min in 150-ml sterile physiological saline supplemented by 0.1% peptone, using a Colworth Stomacher (Stomacher, Lab. Blender 400). From this homogenate decimal dilutions were made in duplicates.

Psychrotrophic aerobic bacteria:

Psychrotrophic colony forming units were determined in Plate Count Agar (PCA, Oxoid CM 325) incubated for 5 days at 20°C (Zeitoun and Debevere, 1990; Russell *et al.*, 1997).

***Enterobacteriaceae*:**

Enterobacteriaceae were determined as colony forming units on Violet Red Bile Glucose Agar (VRBG, Oxoid CM 485) with an overly of the same agar incubated at 37°C for 18 hr. (Zeitoun and Debevere, 1992; Zeitoun, *et al*., 1994).

Staphylococcus aureus

Staphylococcus aureus was enumerated on Baird Parker Agar (Oxoid CM 275). Plates were incubated at 37°C for 48 hr. Colonies with black, shiny, convex, 1-1.5 mm diameter, narrow white entire margin and surrounded by a zone of clearing 2-5 mm in width were counted as *Staphylococcus aureus* (Adesiyun, 1995).

Isolation of *Salmonella*.

Thrity chickens breast (for each company) were sampled aseptically by means of excision of surface areas of 25 cm^2. A sterile filter paper (5 x 5 cm) was used to outline the area. Filter paper and skin were homogenized for 2 minutes in 250 ml of sterile buffered peptone water (Oxoid CM 509) incubated at 37°C for 24 hr. After incubation 1 ml of green enrichment cultures were transferred to 10 ml of Tetrathionate Broth (Oxoid CM 29) and incubated at 42°C for 24 hr. (AL-Rajab *et al.*, 1986). These enrichment cultures were streaked on Xylose Lysine Desoxycholate (XLD) (Oxoid CM469) and on Brilliant Green Agar (BGA) (Oxoid CM329). The plates were incubated at 35°C for 24 hr. Colonies, red with black centers (On XLD) and red colonies surrounded by bright red (on BGA) were picked off the plates and subcultured to triple sugar from Agar (Merck No. 3915), Lysine Decarboxylase Broth (Oxoid CM 308) and Urea Agar Base (Oxoid CM53). The slants were incubated at 35°C for 24 hr (AL-Rajab *et al.*, 1986).

Identification of *Salmonella*:

Positive *Salmonella* colonies were identified by using Minitek System (BBL).

pH:

The pH was determined by blending 10 g of chicken breast in 100 ml of distilled water and the pH was measured using pH meter (Hanna instruments, USA).

Compositional analysis :

Moisture, ash and fat contents were determined according to AOAC (1985). Protein contents were determined according to Egan et al., (1981).

Statistical analysis :

Obtained data were subjected to the proper analysis of variance of the completely randomized design, according to Gomez and Gomez (1984). Least significant difference (LSD) at 0.05% level of significant was used to compare the treatment means (Waller and Duncan, 1969). Computation were done using SAS (1996).

RESULTS AND DISCUSSION

High counts in foods indicate contaminated raw materials and/or unsatisfactory processing and/or cross contamination after processing from a sanitary point view (ICMSF, 1988). The results of total Psychrotrophic aerobic bacteria on frozen chickens are shown in Table 1. The mean values of total Psychrotrophic aerobic bacteria on locally produced and imported frozen chickens were 3.92 and 2.80 $\log_{10}$ CFU/cm^2, respectively. Data also indicated that the total Psychrotrophic aerobic bacteria on frozen chickens (Locally produced and imported) were less than $\log_{10}$ = 4.7 CFU/cm^2. This is mainly due to the effect of freezing on the growth of microorganism (Lambert *et al.*, 1991).

Table (1): Total psychrotrophic aerobic bacteria, *Enterobacteriaceae* and pH values of frozen chickens at Al-Hassa supermarkets.

Company	Psychrotrophic aerobic Log_{10} CFU/Cm^2	*Enterobacteriaceae* CFU/Cm^2	PH- value
1. Locally produced			
A	3.67^{cd}	24.67^{c}	5.88^{cd}
B	3.88^{c}	143.33^{b}	5.83^{de}
C	4.66^{a}	301.67^{a}	5.87^{cd}
D	4.12^{b}	409.00^{a}	5.86^{cd}
E	3.63^{d}	23.33^{c}	5.82de
S	3.66^{d}	27.00^{e}	5.96^{b}
G	3.84^{cd}	30.33^{e}	6.04^{a}
Mean	3.92^{A}	137.05^{A}	5.90A
2. Imported			
H	2.82^{f}	0.00^{f}	5.76f
I	3.16^{e}	1.00^{e}	5.80fe
J	2.40^{g}	3.00^{d}	5.79fe
K	2.76^{f}	1.00^{e}	5.83^{de}
L	2.86^{f}	0.00^{f}	5.78^{fe}
Mean	2.80^{B}	1.00^{B}	5.79^{B}

1. A, B, C, D, E, S and G are locally produced companies.
2.H, I, J, K and L are imported companies.
3.CFU= colony forming units.
4.^{abcdfg} values in the same column with the same letter are not signiicantly different (P> 0.5).
5. ^{AB} means in the same column with the same letter are not signiicantly different (P> 0.5).

The assessment of *Enterobacteriaceae* commonly formed a part of the microbiological quality monitoring of foods processed for safety, and their presence in numbers of CFU exceeding carefully established levels is traditionally related to hygiene and safety (Mossel, 1975; Mossel *et al.*, 1979; Zeitoun, *et al*., 1994).

The number of *Enterobacteriaceae* on imported frozen chickens ranged from 10>0 to 3 CFU/cm^2 (Table 1). Meanwhile the number of *Enterobacteriaceae* on locally produced chickens ranged from 23 to 409 CFU/cm^2. The hygiene quality of imported frozen chickens was higher than that of the locally produced one. The presence of *Enterobacteriaceae* on frozen poultry at low numbers would improve the safety of the frozen chickens. It seemed that *Enterobacteriaceae* were sensitive to freezing (Lambert *et al.*, 1991). Results obtained for *Enterobacteriaceae* confirmed those obtained for total psychrothrophic aerobic bacteria (Table 1).

The pH values of frozen chickens atAl-Hassa supermarkets ranged from 5.79 to 5.90 for locally produced and impoted poultry respectively. A similar result was obtained by Carboni *et al.* (1998).

The composition of poultry meat not only influences the microbial spoilage population , but plays an important role in determining the spoilage pattern.. The average composition of imported poultry meat is 74.42% water, 21.87% protein, 2.81% lipids and 0.91% Ash (Fig. 1).Meanwhile the average composition of poultry locally produced is 74.99%water, 19.93% protein, 3.93%lipids and 1.14% ash.The differences were significant for protein , lipids and unsignificant for water and ash.

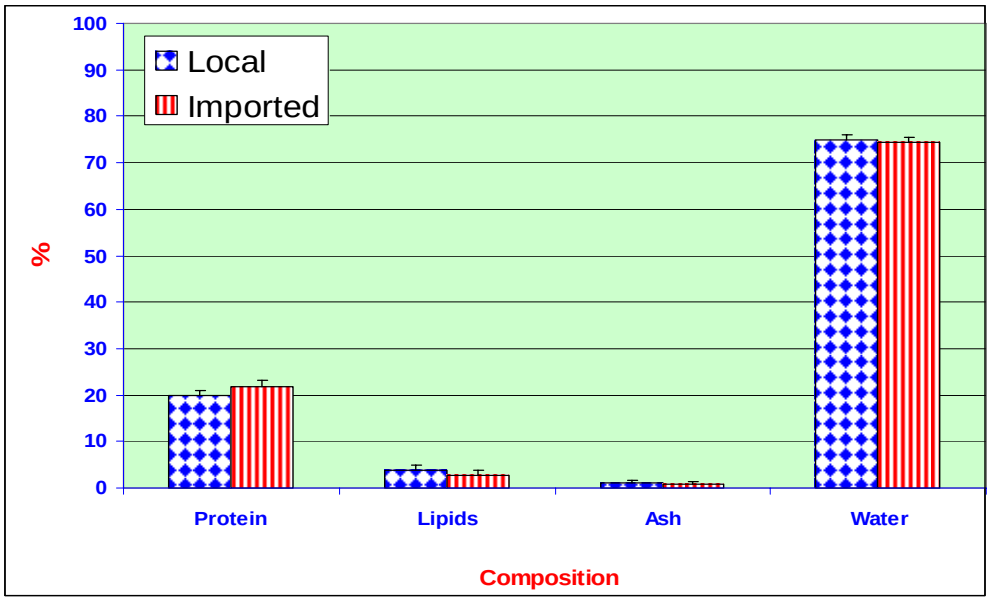

Fig1. Compositional analysis of locally produced and imported poultry.

Because *Salmonella* are a public health hazard, it is essential that efforts be directed toward their elimination from eviscerated poultry. However, the entry for slaughter of *Salmonellae* contaminated chickens (Carriers) makes the elimination of *Salmonellae* from these carcasses a difficult task (Cunningham, 1982; Izat *et al.*, 1989). The incidence of contamination by *Salmonellae* in frozen poultry is given in Table 2. The recovery of *salmonellae* from 72 of 360 frozen chickens in this survey suggested that poultry remained a potentially dangerous reservoir of these pathogens (Carraminana *et al.*, 1997; Hung and Tollefson, 1998).

Table (2). Incidence of *Salmonella* in frozen chickens at Al-Hassa **supermarkets.**

Company	No. of samples	No. of samples containing *Salmonella*	Percent
1. Locally produced			
A	30	4	13
B	30	11	37
C	30	6	20
D	30	9	30
E	30	3	10
S	30	9	30
G	30	15	50
Mean	30	8.14	27.14
2.Imported			
H	30	1	3
I	30	4	13
J	30	1	3
K	30	9	30
L	30	0	0
Mean	30	3	9.8
Total	360	72	20

1. A, B, C, D, E, S, and G are locally produced companies.
2.H, I, J, K and L are imported companies.

A total of eight *Salmonella* sterotypes (Table 3) were isolated; *S. typhimurium* was predominant 27.78%, followed by *S. hadar* 26.39%; *S. enteritidis* 16.66%, *S. virchow* 15.28%; *S. heidelberg* 5.55%; *S. infantis* 4.17%; *S. cerro* 2.78% and *S. anatum* 1.39%..Zivkovic *et al.*, (1997) reported that *S. typhyimurium* and *S. hadar* were the most commonly found serovars in frozen poultry which are in agreement with the present investigation.

Table (3). Serotypes of *Salmonella* isolated from frozen chickens at Al-Hassa supermarkets .

Serotypes	No. of strains	Percent
Salmonella typhimurium	20/72	27.78
Salmonella hadar	19/72	26.39
Salmonella enteritidis	12/72	16.66
Salmonella virchow	11/72	15.28
Salmonella heidelberg	4/72	5.55
Salmonella infantis	3/72	4.17
Salmonella cerro	2/72	2.78
Salmonella anatum	1/72	1.39

Poultry products have been incriminated in outbreaks of *Staphylococcus* food poisoning (Cunningham, 1982). Science processed poultry is handled considerably, it may be expected that bacteria may be contributed by processing line workers as well as occurring as a natural contamination of the skin and feathers of birds (Cunningham, 1982). Data in Table (4) revealed that the numbers of *Staphylococcus aureus* on locally produced frozen chickens ranged from 33 to 1200 CFU/cm^2. Meanwhile the numbers of *Staphylococcus. aureus* on imported frozen poultry ranged from 100>00 to 150 CFU/cm^2.

Table (4). *Staphylococcus aureus* on frozen chickens at Al-Hassa supermarkets.

Company	CFU/Cm^2
1. Locally produced	
A	66.67^{cd}
B	100.00^{abc}
C	83.33^{bc}
D	200.00^{abc}
E	1200.00^{a}
S	$33.33d^{e}$
G	333.33^{ab}
Meanm	288.10^{A}
2. Imported	
H	0.00^{e}
I	50.00^{cd}
J	66.67^{cd}
K	0.00^{e}
L	150.00^{abc}
Mean	53.33^{B}

1. A, B, C, D, E, S, and G are locally produced companies.
2.H, I, J, K and L are imported companies.
3.CFU= colony forming units.
4.^{abcdfg} values in the same column with the same letter are not signiicantly different (P> 0.5).
5. ^{AB} means in the same column with the same letter are not signiicantly different (P> 0.5).

In conclusion, the hygiene quality of imported frozen chickens was higher than that of the locally produced one.

The authors stress on the importance of good hygiene practice and risk analysis at the broiler processing plants. Scince poultry meat is processed , and then distributed and sold at retail out-lets often far removed from the primary processor, the poultry processor must employ methods for both short and long term preservation of poultry meat. Such methods must be capable or either sup-pressing or killing both pathogenic and spoilage micro-organisms without the addition of any toxic substances.

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الملخص العربي

الجودة الصحية للدواجن المجمدة في محلات السوبر ماركت بالإحساء .

أشرف عبد المنعم محمد زيتون و صلاح محمد العيد
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تم تجميع عدد (٣٦٠) عينة دجاج مجمدة ذات قيمة اقتصادية من أسواق الأحساء وممثلة لأثني عشر شركة ، سبع منها إنتاجها محلي للدواجن المجمدة والأخرى شركات استيراد . تم تقدير العدد الكلي للبكتريا الهوائية المحبة للبرودة وأيضا تم تقدير بكتريا *Enterobacteriaceae* والـ *Salmonella* Spp. وتم عمل الـ Serotypes للسالمونيلا المعزولة وأيضا تم تقدير الـ *Staphylococcus aureus* وتحديد رقم الـ pH . وقد أظهرت النتائج أن متوسط العدد الكلي للبكتريا الهوائية المحبة للبرودة كان Log_{10} 3.92 في المحلي و Log_{10} 2.80 في المستورد . أيضا أوضحت النتائج أن عدد الـ *Enterobacteriaceae* والـ *Staphylococcus aureus* في الدواجن المستوردة أقل من المنتج محليا وكان الفرق معنوى . وتراوح رقم الـ pH في صدور الدواجن ة بين ٥,٧٩ في الدواجن المستوردة إلي ٥,٩٠ للدواجن المحلية. وأظهرت نتائج تحليل ٣٦٠ عينة دجاج وجود السالمونيلا بنسبة ٢٠% (٣٦٠/٧٢) . وتم عزل ثمانية Serotypes مختلفة وكانت الـ *S. typhimurium* هي الغالبة بنسبة ٢٧,٧٨% ويتبعها *S. hadar* ٢٦,٣٩% والـ *S. enteritidis* ١٦,٦٦%والـ *S. virchow* ١٥,٢٨% والـ *S. heidellerg* ٥,٥٥% والـ *S. infantis* ٤,١٧% والـ *S. cerro* ٢,٧٨% والـ *S. anatum* ١,٣٩% . وكانت الجودة الصحية للدجاج المجمد المستوردة أعلي من ذلك المنتج محليا . لذلك يوصي الناشرون بممارسة الشروط الصحية الجيدة و اتباع نظام تحليل المخاطر و نقاط التحكم الحرجة في مصانع الدواجن .