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SANITARY STATUS OF MARKETED FROZEN CHICKEN PRODUCTS EXHIBITED IN PRESENTATION FREEZERS

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SUMMARY

A total of eighty samples of chicken products; 20 each of boneless chicken meat, boneless chicken breast, chicken half legs and chicken drum stick were collected form different markets and examined for the bacteriological status of these products. The obtained results revealed that aerobic plate count, coliforms, enterobacteriaceae and staphylococci mean counts were significantly higher in boneless chicken meat followed by boneless chicken breast then chicken half legs and finally chicken drum stick samples. Salmonella infantis could be isolated only from boneless chicken meat with incidence (5%), while Campylobacter jejuni was detected in both boneless chicken meat and breast (5% of each). The source of contamination to chicken products and the public health importance of the isolated organisms as well as the suggestive measures to minimize microbial contamination of chicken products and also to safeguard consumers were discussed.

INTRODUCTION

The quality of poultry meat is considered optimum immediately after processing and maintainance of acceptable quality depends on the initial microbial levels and measures taken to minimize growth of pathogenic organisms which may under faulty handling lead to a health hazard (Cunningham, 1982).

The spoilage of poultry carcasses stored under cold temperatures was caused mainly by the growth of Psychrophiles (Barnes and Impey, 1968).

S. aureus derives its importance in meat hygiene from its potential production of staphylococcal enterotoxins which leads to food poisoning in human being (Niskanen, 1977; Tolba, 1991 and 1994). Moreover, poultry meat was shown to be the vehicle of disease producing organisms (Khalafalla and Waffiah, 1995 and Tolba et al., 1998).

Spread of Salmonellae in processing plants occurs during processing operations, market poultry becomes contaminated to varying degrees as a result of unsanitary handling and retailing conditions (Bryan, 1968). In addition, contamination of market poultry carcasses depends mainly on the sanitary practices applied during handling, processing, storage, distribution and retailing conditions (Dougherly, 1976 and Khalafalla and Waffiah, 1995).

Clostridium perfringens found in the intestinal tract of chickens, poultry processing operations can spread the organism (Barnes, 1972) which has been isolated from carcasses at various stages of processing.

In recent years, reports have demonstrated the importance of Campylobacter jejuni and Escherichia coli as a source of human enteritis (Garcia et al, 1985). Moreover, investigation of chicken processing plants in different countries have shown that large contamination with Campylobacter jejuni can exist in birds, equipments, hands of processing line workers (Oosterom et al. 1983; Wempe et al., 1983 and Stern et al., 1985).

There are many factors affecting the growth of bacteria, in general food poisoning organisms stop growing at temperatures which still permit the growth of spoilage bacteria, many of which can multiply slowly at -2°C. However, all bacterial growth ceases when the poultry products becomes frozen, while above freezing point the spoilage organisms grow faster with increasing temperature.

This work was conducted to determine the effect of flactuation of temperatures during storage of chicken products in the presentation freezers.

MATERIAL AND METHODS

A total of eighty random samples of boneless chicken breast, boneless chicken meat, chicken half legs and drum stick (20 samples each) were collected from the finished products of different markets. Collected samples were transferred directly to the laboratory with a minimum of delay. Collected samples were carried out according to the techniques recommended by ICMSF (1980). The following bacteriological examinations were done.

1- Determination of Aerobic Plate Count (APC/ g):-

The drop plate technique recommended by ICMSF (1978) was employed. Inoculated plates with control were incubated in a thermostatically controlled incubator at 37±1°C for 48 hours for enumeration of aerobic mesophilic bacteria.

2 - Determination of Enterobacteriaceae count /g:-

The technique applied was that recommended by ISO (1987) using Violet Red Bile Glucose (VRBG) agar. Inoculated plates with control were incubacted at 37°C for 24 hours.

Representative colonies were identified biochemically according to Vernam and Evans (1991).

3 - Determination of Coliforms Count (MPN/g):

MPN/g was determined according to ICMSF (1978) and ISO (1975). Inoculated tubes were incubated at 37°C for 24 hours for enumeration of most probable number of coliforms (MPN/g).

4 - Determination of Staphylococci count /g:-

Surface spread plate method according to ICMSF (1978) was applied. Inoculated Baird Parker plates with control were incubated at 37°C for 24-48 hours for enumeration of S. aureus.

5 - Isolation and Identification of Salmonellae:-

The technique adopted was that recommended by Harvey and Price (1981), suspected colonies were identified biochemically according to Kauffman white scheme (Kauffmann, 1974).

6 - Isolation and Identification of E. coli :-

The applied technique was recommended by ISO (1987). Identification of typical E. coli according to Vernam and Evans (1991).

7- Isolation and Identification of Clostridium perfringens:-

Suspected colonies were identified according to Raper and Fennell, 1965; Zycha et al., 1969; Barnnett and Hunter, 1972 and Samson, 1979.

8- Isolation and Identification of Staph. aureus :-

Suspected colonies were identified morphologically (Cruickshank et al., 1975) and biochemically (ICMSF, 1978).

The obtained results were statistically analyzed using Hypothesis test of mean and correlation coefficient according to Senedecor (1969).

RESULTS AND DISCUSSION

From the results achieved in Table (1) and Fig. (1). It is evident that boneless chicken meat samples as compared with those samples of boneless chicken breast have a significant higher mean values ± S.E. of Aerobic mesophilic count, Colifoms, Enterobacteriaceae and Staphylococci counts were $3.2 \times 10^5 \pm 2.1 \times 10^5$, $6.1 \times 10^2 \pm 2.9 \times 10^2$, $1.5 \times 10^3 \pm 2.3 \times 10^2$ and $2 \times 10^3 \pm$

Table (1) : Statistical analytical results of examined chicken products kept in presentation freezers based on determination of their hygienic status.

Type of examined samples	No. of samples	APC	Coliform count	Enterobacteriaceae count	Stophylococci count
Bondess chicken meat Min Max Meat ± S.E. R Log mean	20	7.2x 10^3 4x 10^6 3.2x10^5±2.1x10^5 +0.949 5.51	10 2 6 x 10^3 6.1x10^2±2.9x102** + 0.707 2.79	8 x10^2 4.6 x 10^3 1.5x10^3±2.3x102* - 3.18	9 x 10^3 10^4 2x10^3± 6.2x102* +0.944 3.30
Boneless chicken breast Min Max Mean ± S.E. R Log mean	20	6 x 10^3 2.6x10^5 2.1x105±1.4x105 - 5.32	15 3 x 10^3 2.1x10^2±1.5x10^2 + 0.732 2.32	6.4 x 10^2 4 x 10^3 1.4x10^2±2.1x 10^2 + 0.380 3.15	6 x 10^2 8 x 10^3 1.1 x 10^3 ± 3.7 x 10^2 - 3.04
Bondess half legs Min Max Meat ± S.E. R Log mean	20	7 x 10^2 2.2 x 10^6 1.1 x 10^5 ± 10^5 - 5.04	< 3 2 x 10 2 48.4 ± 12* - 1.69	1.1 x 10^2 3.5 x 10^3 9.3x10^2 ±2.1 10^2* + 0.193 2.97	10^3 7 x 10^3 7x10^2 ±3.5x 10^2 - 2. 85
Chicken drum stick Min Max Mean ± S.E. R Log mean	20	3.1 x 10^2 3 x10^5 3.6x10^4±2.1x10^4 - 4.56	< 3 90 39± 9.5 + 0.152 1.59	1.3 x 10^2 2.7 x 103 6.7x10^2±1.6x 10^2 - 2.83	10^2 5 x 10^3 5.4 x 10^2 ±2.5 x 10^2 - 2.73

* Significant at $p < 0.005$
** Significant at $p < 0.001$

Correlation coeffeclent between APC and *S. aureus* count in boneless chicken meat.

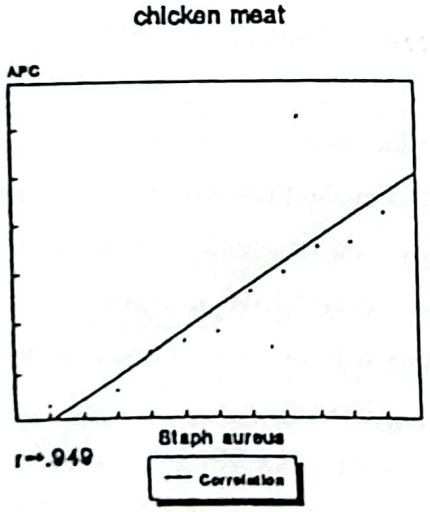
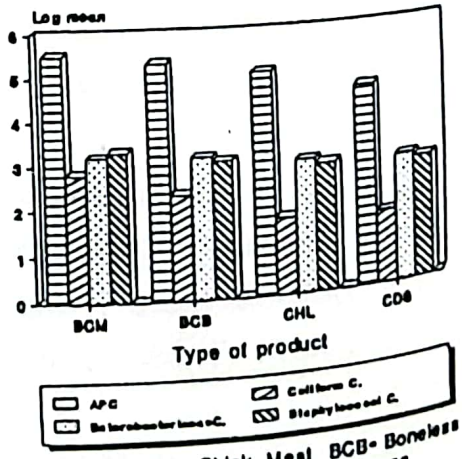


Fig. (1): Log mean of microbiological examination of chicken products.



BCM= Boneless Chick. Meat BCB= Boneless Chick. Breast CHL= Chick. Half Legs CDB= Chick. Drum Stick

6.2×10^2 for former against $2.1 \times 10^5 \pm 1.4 \times 10^5$, $2.1 \times 10^2 \pm 1.5 \times 10^2$, $1.4 \times 10^3 \pm 2.1 \times 10^2$ and $1.1 \times 10^3 \pm 3.7 \times 10^2$ for later respectively, such counts were slightly decreased to $1.1 \times 10^5 \pm 10^5$, 48.4 ± 12, $9.3 \times 10^2 \pm 2.1 \times 10^2$ and $7 \times 10^2 \pm 3.5 \times 10^2$ c.f.u. / gm in examined chicken half legs, while they were $3.6 \times 10^4 \pm 2.1 \times 10^4$, 39 ± 9.5, $6.7 \times 10^2 \pm 1.6 \times 10^2$ and $5.4 \times 10^2 \pm 2.5 \times 10^2$ in examined drum stick respectively.

The obtained results revealed that the aerobic plate count in most products was over than the permissible limits (105), this may be attributed to the frequent thawing and refreezing of chicken products kept in some presentation freezers as a result of ineffeciency of cooling system which may be due to careless in covering such freezers by its cover lids resulted in a partial loss of freezing degrees and subsequently accelerate the growth and multiplication of food spoilage organisms.

In this respect, Sauter et al., (1978) mentioned that the number of salt tolerant bacterial were declined rapidly after freezing storage, while they become relatively constant during thawing of chicken products. This may be attributed to the effect of freezing and subsequent thawing causes tissue disruption releasing nutrients which required to improve the metabolic activity of salt tolerant bacteria. The authors revealed that APC and S. aureus counts of examined frozen and thawed chicken products were 2.1×10^4 and 1.1×10^3 organism/g respectively. This substantiates the findings reported in the present investigation, while lower findings of APC and enterobacteriaceae counts were reported by Notermans and Kamplemacher, 1975 (3.2×10^3 and 3.2×10^2) respectively. Moreover, the obtained results of APC of examined boneless chicken breast and drum stick samples were higher than those obtained by Kotula, 1966 (1.1×10^3 and 8.7×10^2) respectively. Kraft et al., 1963 found that the examined frozen chicken product samples attaining APC, S. aureus and colifroms counts 3.6×10^4, 6.9×10^2 and 5.2×10^2 organism /g. respectively. These results agree with that reported in the present investigation.

Presence of coliforms ogranisms in great numbers indicates contamination from faecal materials and lack of careful handling during processing. This helds the view reported by Pini and Gilbert (1988) and Hudson and Mead (1989). Moreover, Ostovar et al., 1971. revealed that freezing of deboned poultry carcasses resulted in a significant reduction of faecal coliforms.

Weak and direct correlations were noticed between S. aureus and enterbacteriaceae ($r=+0.380$), enterebacteriaceae and coliforms ($r=+0.193$) and between staphylococci and coliforms ($r=+0.152$) in examined boneless chicken breast, chicken half legs and drum stick respectively. However, the correlation coefficient was

stronger between enterobacteriaeae and coliforms in boneless chicken meat and boneless chicken breast than those of other products (r=+0.707 and +0.732) , the correlation was higher between staphylococci and each of APC and coliforms in boneless chicken meat (r=+0.949 and +0.944).

On the other hand, significant higher mean value (p<0.005) of enterobacteriaceae and staphytococci and between enterobacteriaceae and coliforms in examined boneless chicken meat and chicken half legs were observed respectively, while strong higher mean value (P<0.001) were noticed between coliforms and staphylococci in booneless chicken meat than the other products.

Notermans and Kampelmacher (1975) revealed that there is no significant difference regarding the regression coefficient between APC and enterobacteriaceae counts. These results are consistent with that reported in the present investigation. In this respect, Cox et al. (1974) found that there is no significant difference in mean value at (P<0.05) of APC and enterobacteriaceae counts in examined boneless chicken breast and chicken drum stick samples. These results agree with that reported in the present investigation.

From the present data it could be concluded that Achromobacter, Citrobacter freundii, Enterobacter agglumerans, Enterobacter aerogenes Flavobacterium, Proteus vulgaris, Proteus myxo

Table (2): Frequency distribution of isolated organisms from examined chicken products .

Isolated Organisms	Type of samples								Total No. of positive	
	Boneless chicken				Chicken half legs		Drum stick			
	meat		breast							
	No	%	No	%	No	%	No	%	No	%
Achromobacter	1	5	-	0.0	-	0.0	-	0.0	1	5
Citrobacter C. freundii	2	10	2	10	1	5	1	5	6	30
Enterobacter E.agglumerans	1	5	1	5	2	10	-	0.0	4	20
E. aerogenes	4	20	-	0.0	-	0.0	1	5	5	25
Flavabacterium	1	5	-	0.0	-	0.0	-	0.0	1	5
Proteus P. vulgaris	1	5	2	10	-	0.0	-	0.0	3	15
P.myxofaciens	-	0.0	1	5	-	0.0	-	0.0	1	5
E.coli	3	15	2	10	1	5	1	5	7	35
Klebsiella : K.ozonae	1	5	1	5	1	5	1	5	4	20
K.cloacae	1	5	1	5	1	5	1	5	4	20
Clostridium perfringens	2	10	3	15	1	5	1	5	7	35
S. aureus	1	5	-	0.0	-	0.0	1	5	2	10
Sal. Infantis	1	5	-	0.0	-	0.0	-	0.0	1	5
Campylobactor jejuni	1	5	1	5	-	0.0	-	0.0	2	10

faciens , E. coli , Klebsiella ozonae, Klebsiella cloacae, Clostridium pefringens, S. aureus and Campylobacter jejuni could be isolated from the examined samples at different percentages ranged from (5% to 35%) , while Salmonella infantis could be isolated from examined boneless chicken meat only (5%). (Table2). The results of salmonella isolation are relatively consistent with that reported by Bryan (1968) who pointed out that the incidence of salmonellea in examined poultry meat and their products from retail markets varied from 1 to 50%. In this respect, Roberts , 1972 and Watson , 1975 revealed that the incidence of salmonellae isolated from poultry meat ranged from 3% to 62%. Moreover, Sadler and Corstvet, 1965 and Glezen et al., 1973 could isolate Sal. infantis from examined chicken meat products. This substantiates the findings reported in the present investigation. On the other hand, Ostvar et al. (1971) could isolate Clostridium perfringens, S. aureus, achromobacter, flavobacterium from examined frozen chicken products with different percentages.

The results of S. aureas isolation recorded here are relatively more or less inaccordance with that previously reported by several investigators (Surkiewicz et al., 1969; Sauter et al., 1978 and Devriese, 1980). Healthy poultry tissues does not support prolonged growth of staphylococci, while bruised tissues will allow persistance of such organism. This agree with hypothesis reported by Genigeorgis and Sadler (1966) and Cunningham (1982).

Campylobacter jejuni isolation rates were even higher than those of Salmonellae. This agree with that reported by Bruce et al., 1977; Butzler , 1978; severin, 1978 and blaser et al., 1979, while lower incidence of Campylobacter jejuni from examined chicken carcasses was recorded by El-gamal et al.,1992 (4%).

Presence of coliforms in chicken products may be indicative of defective techniques applied during preparation, handling, processing and storage which may lead to economic losses through the development of undesirable changes rendering the product of low quality or even unfit for consumption (Chambers et al., 1976 and ICMSF , 1978). Moreover , some of the isolated organisms have been implicated in food illness e.g. proteus species, citrobacter freundii, enterobacter species and klebsiella species (Krieg and Holt, 1984; Marzouk, 1985; Elmossalami et al., 1988 and Abdel- Aziz , 1993).

Microorganisms that have been implicated in food poisoning outbreaks attributed to poultry meat are mainly Salmonellae, S. aureus, Campylobacter and E. coli Poor hygienic conditions during processing as well as fluctuation of storage temperature in presentation freezers may allow the organisms to survive and multiply or reinfect the cooked food and leads to food poisoning when the food is consumed .

Improving the sanitary status of chicken products and safeguard the consumers from receiving contaminated chicken products can be achieved by prolonging the durability of the product through application of a strict hygienic measures during preparation , storage and handling which is helpful in reducing its bacterial load which in turn protect the product from being spoiled in the retail markets . Moreover , it protects the consumer from pathogens which may be present in chicken products .

On the manufacturing side to test the raw materials and to control the processing conditions , Good manufacturing practices (GMP) should be followed by the codex Alimentarius Commission (CAC) (1976) ; Code of hygienic practices for processed products.

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