BACTERIOLOGICAL QUALITY OF HALFCOCKED CHICKEN MEAT PRODUCTS

Moustafa, N. Y.*, Tolba, K. SH.** and Rania, H. EL-Shehawy**

** Animal Health Research Institute, Mansoura Lab., Mansoura, Egypt.
*** Animal Health Research Institute, Giza Lab., Giza, Egypt.

1 (raniahassan602@gmail.com)

ABSTRACT

A total of 60 random samples of half cooked chicken meat products (chicken nuggets, chicken burger and chicken luncheon) were collected from different supermarkets at El- Dakahlyia, governorates (mansoura city) as 20 sample for each for bacteriological examination (These 60 samples were analyzed and tested for total aerobic plate count, total enterobactracea count, total Staph count, total mold and yeast count, The presence of bacterial food pathogens was also evaluated in the examined sample (S. aurous). The obtained results indicated that chicken Luncheon has high microbial count $6.6 \times 10^7$, for APC the lowest value was in Nuggets $3.6 \times 10^6$. This study offers determination of hygienic status, quality of chicken meat products heat treated. All recommendation to safeguard the consumer were discussed.

Keywords: Half cooked, Chicken meat, Bacteriology.

INTRODUCTION

Chicken and chicken meat products provide animal protein of high biological value for consumers at all ages, where they contain all the essential amino acids required for human growth, higher proportion of unsaturated fatty acids and less in cholesterol value. Moreover, Poultry
meat products are highly desirable, palatable, digestible and nutritious for all ages. Further processing of poultry meat involves conversion of raw poultry carcasses into value added products e.g. reconstructed products, cold cuts or breaded products. Advantages of further processing of poultry meat are improving juiciness and flavor, shelf life and water holding capacity (*Sahoo, et al. 1996*).

Chicken, chicken meat products are good sources of animal protein of high biological value, which contain all the essential amino acids required for human nutrition, besides that they contain higher proportion of unsaturated fatty acids and less cholesterol especially when skin removed (*Shedeed, 1999*).

The acceptance of further processed chicken meat products depends upon overall acceptance, color, odour, taste and consistency. So, consumers had given much greater choice over the foods which are more selective, of high quality and cheap about the value of money. Finally, the products quality becomes more significant factor in meat products marketing (*Potter, 2001 and Agamy and Hegaz, 2011*).

Aerobic plate counts in food samples may be useful to indicate quality, shelf life and post heat processing contamination (*GuaranTek Analytical Laboratories, 2003*).

Aswell as Total bacterial enterobacteriaceae and fungal counts are considered as incidences of quality, which give an idea about the hygienic measures during further processing and help in assessing the keeping quality of further processed chicken meat products (*Aberle et al., 2001*).
Chemical analysis of further processed chicken meat products is greatly varied, so, tasting of the final products is a common practice in cooked and uncooked chicken meat products and applied to ensure the compliance of such products with the legal and composition of standards written on the label *(Beckers, 1998)*.

Poultry products can be a route of introduction of pathogenic bactericium. Therefore, the microbial content of these products should be minimized for consumption *(Carvalho et al., 2005)*.

Food handlers are the primary source of S.aureus contamination in the processing plant. Most staphylococcal intoxications involving poultry products are related to recontamination of cooked product by food handlers, followed by improper holding temperature *(NACMCF, 1997)*.

The consequences of contamination of food with bacterial pathogens can be particularly serious on many patients who may have impaired resistance to infection. Many hospital food handlers are probably not aware of the tremendous threat they pose to patients *(Aycicekctai, 2004a)*.

Personal hygiene may refer to the cleanliness of a person’s body. The health of workers plays an important part in food sanitation. People are potential sources of microorganisms that cause illness to others through food poisoning.

Processing of poultry products requires a severe microbiological quality control, considering they are one of the main source of food born infections. Enterobactreacies family is a group of bacteria that is used to assess the general hygienic status of food product *(HPA, 2004)*.
Cohen et al., (2007) Contamination of poultry meat by *S.aureus* can be occurred from different retail outlet sites and appliances such as cages, bleeding knife, drum, wooden log, cutting knife, polymesophiles, *S. aureus* and coliforms. The author reported that 80% of chicken burger were un acceptable on the base of Spain microbiological standards, concluded that the highest bacterial counts especially aerobic plate count and fecal coliforms in poultry meat products were recorded in hot season. The high levels of microbial contamination and occurrence of pathogens reflects the poor hygienic quality of poultry meat under these conditions.

BKhect et al., (2007) concluded the highest bacterial counts especially aerobic plate count and fecal coliforms in poultry meat products (chicken burger and chicken nugge 50 samples of frozen chicken nuggets and strips (25 of each) were examined microbiologically. The mean values of microbiological indices in the frozen chicken nuggets and strips for total aerobic plate counts (cfu/g) were $1.9 \times 10^5 \pm 4.7 \times 10^4$; $7.4 \times 10^4 \pm 1.8 \times 10^4$; Enterobacteriaceae counts were $7.7 \times 10^2 \pm 2.1 \times 10^2$; $1 \times 10^2 \pm 1.3 \times 10$; *Staphylococcus aureus* counts were $5.8 \times 10^3 \pm 1.2 \times 10^2$; $3.4 \times 10^2 \pm 3.8 \times 10^1$ ts).

To ensure that the food is microbiologically safe, both the manipulators (WHO, 2002) and the food need to be continually monitored (Gilling et al., 2001).

Therefore, the objective of the current study was to, assess the hygienic states of some frozen poultry products by determine the level of APC, Staphylococci count, mold, yeast count and enterobactreacea count isolation and identification of staph from chicken meat products.
MATERIAL AND METHODS

2.1. Collection of samples:

A grand total of 60 random samples of half cooked chicken meat products (20 each of chicken nuggets, chicken Burger and, lunchon) were collected from different supermarkets at ElDakahlyiagovernate, (mansoura city) The collected samples were transferred directly to the laboratory in an ice box under complete aseptic conditions without undue delay and then examined bacteriologically.

2.2. Preparation of samples (USDA, 2011):

The samples were prepared according to the technique recommended by (American Public Health Association "APHA" (1992) as follows, twenty five grams of the frozen half cooked chicken products were transferred to a septic blender jar and homogenized with 225 ml of 0.1 % sterile buffered peptone water for 1-2 minutes at 2000 r.p.m. to give an initial dilution of 1/10. one ml of the initial dilution was transferred to another sterile tube containing 9ml of serial buffered peptone (0.1 %) to obtain the next dilution, from which further decimal serial dilutions were prepared

2.3. Determination total of Aerobic Plate Count (APC) (ICMSF, 1978):

It was done using standard plate count agar media. One ml from each of the previously prepared serial dilutions was aseptically poured into duplicate plates of sterile Petri dishes using pour plate method, then about 10ml of sterile melted tempered plate count agar were added and thoroughly mixed in horizontal position. After solidification, the inoculated as well as the control plates were incubated at 37°C for 48 hours in an inverted position. Plates with a range of 30 to 300 colonies were counted. The total aerobic
2.5. Determination of Total Enterobacteacea Count (ICMSF, 1978):

From each of the previously prepared serial dilutions, 0.1 was spread over dry surface of duplicated plates of sterile Violet Red Bile Glucose (VRBG) agar. Then a cover layer (tempered to 45°C) of approximately 5ml of VRGB agar were poured overall the plates. The inoculated and control plates were incubated in an inverted position at 37°C for 24 hrs. All purple suspected colonies surrounded by a purple halos were counted. Enterobacteriaceae count/g was calculated.

2.6 Determination of Total Mould and Yeast count (Cruickshank et al., 1975):

One ml from each of the previously prepared serial dilutions was poured into duplicate Petri dishes using pour plate method of Sabouraud dextrose agar medium supplemented with chloramphenicol and chlorotetracycline (100mg/L of each) as described by Koburger and Farahat, (1975). The inoculated plates were incubated at 25°C and examined daily for presence of colonies. The total fungal count/g was calculated and recorded.


Ten grams of each sample were transferred into a flask containing 90 ml of 0.1% sterile peptone water to get a dilution of $10^{-1}$, one ml of previous mixture was spreaded on mannitol salt agar (MSA) and Baird Parker's agar (BP) medium using a sterile glass rod. The inoculated
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plates were incubated at 37°C for 24 hrs; plates showing colonies from 30 to 300 were selected and counted. From each dilution 0.1 ml was spread onto a dry surface of double sets of Baird parker agar plate (OxoidCM 275, SR54). Inoculated plates were incubated at 37°C for 48 hours. Typical colonies of S. aureus (back shining convex colonies, 1-1.5 mm in diameter with narrow whitemargin and surrounded by a clear zone extending into opaque medium) were enumerated and the average number per gram was calculated (APHA, 1992).

The purified S. aureus isolates were identified through different biochemical tests [catalase test, coagulase test (tube test)] (Quinn, et al., 2002).

Mannitol salt agar medium was used to count Staph. aureus according to the staph. aureus was determined using Mannitol salt agar media. The plates were incubated at 35±2°C for 24 to 48 hrs.

RESULTS AND DISCUSSION

Table (1): Statistical analytical results of different bacterial counts (cfu/g) in examined chicken nuggets samples (n=20)

<table>
<thead>
<tr>
<th>Types of bacterial count</th>
<th>No. of examined samples</th>
<th>Positive samples</th>
<th>Min</th>
<th>Max</th>
<th>Mean±SE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>No.</td>
<td>%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>APC</td>
<td>20</td>
<td>20</td>
<td>100</td>
<td>1x10^3</td>
<td>3.6x10^6</td>
</tr>
<tr>
<td>Yeast &amp; Moulds</td>
<td>20</td>
<td>20</td>
<td>100</td>
<td>2.7x10^3</td>
<td>6x10^3</td>
</tr>
<tr>
<td>Staph. aureus</td>
<td>6</td>
<td>6</td>
<td>30</td>
<td>&lt;10</td>
<td>7.8x10^3</td>
</tr>
<tr>
<td>Enterobacteriaceae</td>
<td>7</td>
<td>7</td>
<td>35</td>
<td>&lt;10</td>
<td>2x10^4</td>
</tr>
</tbody>
</table>

NB: Negative Staph. aureus and Enterobacteriaceae counts (<10 cfu/g) were calculated in One Way Anova as zero count when applying statistical analysis.
Table (2): Statistical analytical results of different bacterial counts (cfu/g) in examined chicken burger samples (n=20)

<table>
<thead>
<tr>
<th>Types of bacterial count</th>
<th>No. of examined samples</th>
<th>Positive samples</th>
<th>Min</th>
<th>Max</th>
<th>Mean±SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>APC</td>
<td>20</td>
<td>20</td>
<td>1.5x10^2</td>
<td>4.3x10^7</td>
<td>2.188x10^6±2.15x10^6</td>
</tr>
<tr>
<td>Yeast &amp; Moulds</td>
<td>20</td>
<td>100</td>
<td>4x10^5</td>
<td>3x10^5</td>
<td>1.598x10^5±1.49x10^4</td>
</tr>
<tr>
<td>Staph. aureus</td>
<td>5</td>
<td>25</td>
<td>&lt;10</td>
<td>4.7x10^3</td>
<td>2.69x10^2±2.34x10^2</td>
</tr>
<tr>
<td>Enterobacteriaceae</td>
<td>8</td>
<td>40</td>
<td>&lt;10</td>
<td>8.3x10^5</td>
<td>4.577x10^4±4.1x10^4</td>
</tr>
</tbody>
</table>

NB: Negative Staph. aureus and Enterobacteriaceae counts (<10 cfu/g) were calculated in One Way Anova as zero count when applying statistical analysis.

Table (3): Statistical analytical results of different bacterial counts (cfu/g) in examined chicken lunchon samples (n=20)

<table>
<thead>
<tr>
<th>Types of bacterial count</th>
<th>No. of examined samples</th>
<th>Positive samples</th>
<th>Min</th>
<th>Max</th>
<th>Mean±SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>APC</td>
<td>20</td>
<td>20</td>
<td>2.9x10^2</td>
<td>6.6x10^7</td>
<td>3.311x10^6±3.29x10^6</td>
</tr>
<tr>
<td>Yeast &amp; Moulds</td>
<td>20</td>
<td>100</td>
<td>4x10^5</td>
<td>3x10^5</td>
<td>1.572x10^5±1.49x10^4</td>
</tr>
<tr>
<td>Staph. aureus</td>
<td>4</td>
<td>20</td>
<td>&lt;10</td>
<td>4.7x10^3</td>
<td>2.59x10^2±2.34x10^2</td>
</tr>
<tr>
<td>Enterobacteriaceae</td>
<td>7</td>
<td>35</td>
<td>&lt;10</td>
<td>1x10^5</td>
<td>5.127x10^3±4.99x10^3</td>
</tr>
</tbody>
</table>

NB: Negative Staph. aureus and Enterobacteriaceae counts (<10 cfu/g) were calculated in One Way Anova as zero count when applying statistical analysis.

It is evident from the results recorded in table (1) that the APC (cfu/g) in the examined samples of half cooked chicken meat products varied from 2.9x10^2 to 6.6x10^7 with a mean value of 3.311x10^6 ± 3.29x10^6 for chicken lunchon 1.5x10^2 to 4.3x10^7 with a mean value of 2.188x10^6± 2.15x10^6fo chicken burger, and 1x10^2 to 3.6x10^6 with a mean value of 1.842x10^5 ± 1.79x10^5 cfu/g for chicken nuggets,
Bacteriological examination of chicken meat products clearly indicated that the chicken nuggets samples had significantly higher bacterial load than either lunchon or burger nearly similar results was observed in El-Hoti et al., (2011); while Osman, (1997 & 2001) and Sofroni et al., (2008) recorded higher mesophilic counts for frozen chicken products. The aerobic plate count gives an idea about the hygienic measures applied during processing and also help in the determination of the keeping quality of the product. The highly aerobic count indicates contamination of raw material or unsatisfactory processing as well as it may be due to unsuitable environmental condition during storage (ICMSF, 1978b) (Heat treated) chicken products samples or due to the fluctuations in storage temperatures. Higher values were observed in ELShora, (1990) who found that the log mean values of of total Aerobic counts of lunchon ,burger are $1 \times 10^3$ and for frozen chicken products and Abd EL-Magied-Walaa, et al., (2009) who found the psychrotrophic count was $1.43 \times 10^5 \pm 0.37 \times 10^5/g$ in breast samples and $4.28 \times 10^6 \pm 0.38 \times 10^6/g$ in wings. In contrast lower values were reported by Zaki-Nadia. Furthermore, the contaminated The obtained results in APC come inaccordance with those reported by Osman-Eman (2001) and Bkheet et al. (2007) forchicken nuggets and Shaltout (2006) forchicken burger. Lower APC in chickennuggets obtained by Osman -Eman (1997) and Al-Dughaym and Altabari (2010). Thehigh total aerobic mesophilic plate countmight be attributed to the contamination ofthe product from different sources or unsatisfactoryprocessing as well as it may bedue to un-suitable condition during storage (Zahran, 2004).
APC of any food article is not a sure indicative for its safety for consumption, yet it is of supreme importance in judging the hygienic conditions under which it has been produced, handled and stored (Jay, 1997a). Also, APC is considered as index of sanitary & quality of foods (Forsythe & Hayes, 1998). Generally, the high bacterial counts of examined meat products may be due to contamination of flesh used for manufacture of these products, however mincing machines, grinders, equipments and knives are considered as the source of contamination of meat during processing (ICMSF, 1996a). As well as, Addition of certain spices during manufacture of meat products may lead to marked increase in bacterial population (Sharaf, 1999).

Total staphylococci count is a good indication of inadequate sanitation and processing as well as the possibility for presence of enterotoxin producing strains as S. aureus (ICMSF, 1996b).

The results recorded in table (2) revealed that the total staphylococci count ranged from <10 to 7.8×10³ with an average value of 4.14×10² ± 3.89×10² cfu/g for chicken nuggets; <10 to 4.7×10³ with an average value of 2.69×10² ± 2.34×10² cfu/g for chicken burger; <10 to 4.7×10³ with an average value of 2.59×10² ± 2.34×10² cfu/g for chicken lunchon,. lower findings were observed in AL-Dughaym and Altabari (2010); ELHoti, el al., (2011) and Wang et al., (1976b) this high count of staphylococcal sp. Indicate bacterial contamination during packing and handling by the workers.

The high incidence of Staph. spp. organisms in chicken products is an indicative of unacceptable level of contamination during handling (Gad, 2004). Also, the presence of S. aureus in food indicates poor hygiene and improper storage conditions (Gundogan et al., 2005).
Moreover, the presence of *S. aureus* in heat treated food may be due to its contamination from food handlers, inadequate cleaned equipment or post-processing contamination (*Duffy et al., 2000*). Nearly similar results were obtained by *Ahmed (2004)*.

**Enterobactreaceai is a better indicator of unhygienic conditions:**

Results achieved in Table (3)) revealed that the total Enterobactreacea count ranged from \(<10\) to \(2 \times 10^4\) with an average value of \(1.855 \times 10^3 \pm 1.06 \times 10^3\) cfu/g for chicken nuggets; \(<10\) to \(8.3 \times 10^5\) with an average value of \(4.577 \times 10^4 \pm 4.1 \times 10^4\) for chicken burger cfu/g; \(<10\) to \(1 \times 10^5\) with an average value of \(5.127 \times 10^3 \pm 4.99 \times 10^3\) cfu/g for chicken lunchon. *Ecoli* was previously isolated from chicken meat products by *Ahmed (2004), Al-Dughaym and Altabari (2010), Sharaf and Sabra (2012), Awadallah et al. (2014)*.

The Presence of *E.coli* in examined samples indicated faecal contamination, potential food spoilage and bad sanitary conditions during production (*Banwart, 1981*) as well as food-borne outbreaks of gastroenteritis. Moreover, the presence of *E.coli* food of animal origin is considered as indicator of faults during preparation, handling, storage or service (*Tebbut, 1999*).

Generally, the presence of enterobactreacea in chicken meat products is considered as an indicator for improper handling and unhygienic conditions after slaughtering, de-feathering, and washing fresh chicken carcasses. Our results were agreed with *Frazier and Westhoff (1983) and Hashim (2003)* while *Abd-ELHaffeiz (1999)* could not detect it from nuggets.
Total mold, yeast count:

Table(4) revealed that the total Mold, yeast count ranged from $2.7 \times 10^2$ to $6 \times 10^5$ with an average value of $3.07 \times 10^4 \pm 2.99 \times 10^4$ cfu/g for chicken nuggets; $4.0 \times 10^2$ to $3 \times 10^5$ with an average value of $1.598 \times 10^4 \pm 1.49 \times 10^4$ cfu/g for chicken burger; $4.0 \times 10^2$ to $3 \times 10^5$ with an average value of $1.572 \times 10^4 \pm 1.49 \times 10^4$ cfu/g chicken lunchon.

According to the legal requirements of Egyptian Organization for Standardization and Quality Control EOSQC, (2005) it is evident that 20, 30 and 20% of Breast, Nuggets and Wings samples respectively had Staph. aureus above the permissible limit. Presence of Staph. aureus may be attributed to inadequate heat treatment, unhygienic handling practices, use of dirty containers, faulty storage and transportation, so the hands and clothes of employees in the production of chicken meat should be over looked (Duffrenne et al., 2001), nearly similar results recorded by Pepe et al., (2006).

The microbial contamination in chicken samples (20.0%). Alvarez et al (2002) recorded relatively higher results of mesophiles, S. aureus, coliform. The author reported that 80% of chicken burger were an acceptable on the basis of Spain microbiological standards,

Cohen et al (2007) concluded that the highest bacterial counts especially aerobic plat counts and focal coli forms in poultry meat products were recorded in hot season.

The high levels of microbial contamination and occupancy of pathogens reflect the poor hygienic quality of poultry meat under these conditions.
Bkheet et al (2007) conclude the highest bacterial counts especially aerobic plate counts and fecal coliforms in poultry meat products (chicken burger and chicken nuggets). The mesospheric counts were $2.6 \times 10^5$ and $3.1 \times 10^5$ respectively.

In conclusion, Rose et. al., (2002) suggested that application of food safety and inspection service (FSIS) and HACCP systems one effective in controlling the contamination of poultry products with human disease causing bacteria, an these performance standards an based on prevalence of salmonella as determined from the FSIS'S nationwide microbial baseline studies and are expressed in term of the maximum number of salmonella, positive samples that one allowed in a given sample set. Also found that salmonella prevalence in most of the product Cato genies was lower of the implementation of HACCP than in pre – HACCP baseline studies and surveys conducted by the FSIS.

REFERENCES


- **Egyptian Organization for Standardization and Quality Control (EOSQC) (2005):** Standard specification No. 3493 for heat treated chicken meat.


- **Forsythe, S. J. and Hayes, P. R., (1988):** Food Hygiene, Microbiology and HACCP. A Chapman and Hall Food Science Book. Aspen


- **GuaranTek Analytical Laboratories (2003):** Microbiology. Web page article.


- **Health Protection Agency. (HPA), (2004):** Food Sampling. National microbiological food studies carried out by the Health Protection Agency and the Local Authorities Co-ordinators of Regulatory Services 243–249(27).


- **International Commission on Microbiological Specification for Foods (ICMSF), (1978b):** Microorganisms in food Vol. 1 Univ. of Toronto Press, Toronto and Buffalo, Canada.


- **Tebbut, G. M. 1999.** Microbiological contamination of cooked meats and environmental site in premise selling both raw and cooked meat products. Inter. J. Environm. Health Research 3(4):209-216


- **Zahran, D.A. 2004.** Using gamma irradiation as an option for controlling bacteria contaminating some foods of animal origin. PhD., Thesis of Meat Hygiene, Faculty Veterinary Medicine, Zagazig University (Banha Branch), Banha, Egypt.

تقييم الحالة الصحية لمنتجات الدواجن المصنعة محلياً

نادر يحيى مصطفى يحيى، خالد شوقي طلبة، رانيا حسن إسماعيل الشهاوي

قسم الرقابة الصحية على الأغذية - معهد بحوث صحة الحيوان - مركز البحوث الزراعية.
قسم الرقابة الصحية على الأغذية - كلية الطب البيطري - جامعة كفر الشيخ.

تعتبر الدواجن ومنتجاتها من الأغذية المفضلة لدى جمهور المستهلكين لاحتوائها على البروتين ذات القيمة الغذائية العالية بالإضافة لسهولة هضمها. وقد تتعرض الدواجن ومنتجاتها أثناء تجهيزها وتلئلاً للتلوث بمختلف الميكروبات التي تؤدي إلى فسادها، بالإضافة إلى أنها في هذه الحالة قد تشكل خطراً على صحة الإنسان لما قد تسببه من تسمم غذائي ونزولات معينة معاوية، لذلك استهدفت الرسالة الوقوف على الحالة الصحية الظاهرية والميكروبية لمثل هذه المنتجات.

استمرت الدراسة على فحص عدد 60 عينة عشوائي من منتجات لحوم الدواجن النصف مطهية المصنعة محلياً من السوبر ماركت بمحافظة الدقهلية (مدينة المنصورة) ممثلة لأشنون الدجاج، برجر الدجاج، ناجيتس الدجاج (20 عينة لكل منهم). ثم اختبار العينات الميكروبياً لتقييم مدى جودة هذه المنتجات (هذه العينات 60 عينة) تم اختيارها وتحليلها للميكروبات الآتية: العدد الكلي للبكتيريا الهوائية واللماكروبات المعوية والفيتربات والخمائر وعد العدد الكلي للميكروبات الكروي الذهبي وقد دلت النتائج على أن أعلى متوسط للعد البكتيري كان في منتج لانشون الدجاج واقل متوسط عدد بكتيري كان في منتج الناجيتس وذلك كمثال للعد الكلي للبكتيريا الهوائية كالتالي 6.6 × 10^6 للبرجر و3.7 × 10^5 للناجيتس.

هذا وقد تم مناقشة النتائج والتوصيات اللازمة وذلك للحد من وجود هذه الميكروبات في منتجات اللحوم للحد من حالات التسمم الغذائي.