



Bacteriological and chemical evaluation of some heat treated chicken products.

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ABSTRACT

A total of sixty commercially produced coated poultry products samples (heat treated) representing, 20 each of (chicken breast, nuggets and wings) were examined to evaluate its quality in terms of bacterial and chemical attributes. Bacteriological analysis showed that the mean values of *aerobic mesophilic*, *Psychrotrophic*, *staphylococcal* and *coliform* counts were $21.6 \times 10^3 \pm 3 \times 10^3$, $11.5 \times 10^3 \pm 2.2 \times 10^3$, $20 \times 10^2 \pm 11 \times 10^1$ and 3.33 ± 0.6 in chicken breast, $42.2 \times 10^3 \pm 3.3 \times 10^3$, $20.7 \times 10^3 \pm 4.5 \times 10^3$, $14 \times 10^2 \pm 4 \times 10^2$ and 3.33 ± 0.8 in nuggets and $60.4 \times 10^3 \pm 10.4 \times 10^3$, $38.5 \times 10^3 \pm 5.4 \times 10^3$, $10 \times 10^1 \pm 7$ and 79.6 ± 6.2 in wings, respectively. Meanwhile chemical analysis showed that, the mean values of TVN and TBA were 27.4 ± 2.6 and 0.59 ± 0.04 for breasts samples, 28.4 ± 1.13 and 0.48 ± 0.12 for nuggets and 27.0 ± 2.1 and 0.65 ± 0.14 for wings. When the obtained results compared with the Egyptian Standards, the examined breast samples were found to be of better quality than the other types of chicken product samples, Meanwhile the incidence of rejected samples as it contain coagulase positive *Staph. aureus* were 20, 30 and 20 % respectively.

Keywords: bacteriology- chemical - (heat treated) chicken meat products.

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1. INTRODUCTION

Commercialization of heat treated chicken products has increased in the recent decades because of its practicality and convenience to prepare, and increase of consumer power (Suderman, 1983; Smith et al., 1985 and Sunderland, 1992). A part from the nutritional aspect, the growing tendency to spend less time on food preparation has lead to a great demand for timesaving heat treated frozen food products also they are very attractive food items due to its low production cost (Antonova et al., 2003 and Patton, 2005) moreover, they are favored by consumers because of the increased palatability provided by a soft and moist interior juiciness and tenderness. Production of heat treated chicken meat products is a complex procedure involving particle size reduction, blending forming, coating and cooking. The possibilities

existing in each of these steps adds to the potential variety of these products but also increases the potential for problems if done incorrectly (Sams, 2001). Poultry meat and their products often get contamination from different sources starting from defeathering, evisceration and subsequent handling during processing in plant (Levin, et al., 2001 and Houf, et al 2002). Many efforts were done to produce a product free from pathogens of public health hazard and with low microbial count improving its keeping quality and keeps its nutritive value to be safe and of high quality. However, many other problems exist like contamination during cutting or maceration of tissues and lose of nutritive values. During freezing of chicken meat products, the growth of many types of microorganism will cease while others especially *psychrotrophic* bacteria

can grow until the medium freezes (Davis and Board, 1998). *Psychrotrophic* bacteria are responsible for many undesirable changes in flavor, odor, texture and color of the food products. The presence of *Staphylococci* and, in particular *Staph.aureus* in the retail breaded chicken products is a potential health risk for consumers since the pH and a_w values of these kinds of products are favorable for *Staph.aureus* growth. The thermal process used during their manufacture can limit staphylococcal contamination but cannot eliminate preformed toxins (Pepe et al., 2006). So the present study was planned to examine some heat treated products for its quality and safety for human consumption through assessment for bacteriological quality in addition, chemical analysis will be performed to assure quality in the aspects of consumer acceptability, degree of freshness

2. MATERIALS AND METHODS

2.1. Samples

A total of 60 samples of coated heat treated chicken products (20 samples of each) breasts, nuggets and wings were collected from different super markets. All samples were subjected to bacteriological and chemical examination.

2.2. Bacteriological examination

Preparation of samples Homogenate: Ten grams from each sample were homogenized with 90 ml sterile 0.1 % peptone solution in a sterile polyethylene bag for 1.5 minutes using stomacher (Lab-blender 400). One ml from the sample original homogenate was added to a test tube containing 9 ml 0.1% sterile peptone water to provide a dilution of 10^2 . Similarly a tenfold serial dilution was prepared (APHA, 2001). And the following bacteriological investigations were performed.

2.3. Enumeration of Total aerobic bacterial count (APHA, 2001)

One ml from each dilution transferred with sterile pipette to each of two separate sterile

Petri-dishes, and then about 10 ml of the sterile standard plate count agar melted at 45°C were poured to each Petri-dish. Inoculated plates after being mixed and solidified were incubated at 37°C for 24-48 hours. Colonies were recorded and counted as total bacterial count cfu/g.

2.4. Enumeration of total Psychrotrophic count

Method applied according to (APHA, 2001), the inoculated plates are incubated in inverted position at 7°C for 10 days. Accordingly, the total *psychrotrophic* bacterial count per gram was calculated on plates containing from 30 to 300 colonies.

2.5. Enumeration of Total Staphylococcal Count

From each dilution 0.1 ml was spread onto a dry surface of double sets of Baird parker agar plate (Oxoid CM 275, SR 54). Inoculated plates were incubated at 37°C for 48hours. Typical colonies of *Staph. aureus* (black shining convex colonies, 1-1.5 mm in diameter with narrow white margin and surrounded by a clear zone extending into opaque medium) were enumerated and the average number per gram was calculated (APHA, 2001)

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

2.6. Enumeration of Total Coliform (MPN/g) (APHA, 2001)

Estimation of *coliforms* was done by using most probable number technique with MacConkey's broth tubes. A series of 3 fermentation tubes containing MacConkey's broth and inverted Durham's tubes were inoculated with 1 ml from the previously prepared 10^{th} fold serial dilutions. After thorough mixing, inoculated and control tubes were incubated at 37°C 24-48 hours. Tubes showing acid and gas were considered as positive for the test. From the laboratory records, the most probable number (MPN)

of *coliforms* /g. was calculated by matching with (MPN) table.

2.7. Chemical analysis

All samples were examined for the following chemical analysis to estimate their compatibility with the Egyptian

standards (EOSQC, 2005). Determination of basic nitrogen (Total Volatile Nitrogen) (TVN) and thiobarbituric acid (TBA) values were estimated as an indicator of the degree of products freshness. Samples will be analyzed in accordance to the methods of FAO, (1980).

3. RESULTS

Table (1): Mean values of bacteriological examination in examined chicken meat samples (Breasts, Nuggets and wings). (N: 20)*

Samples	T. aerobic mesophilic count	T. Psychrotrophic count	T. Staph. Count	T. Coliform count (MPN/g)
Breast	$21.6 \times 10^3 \pm 3 \times 10^3$	$11.5 \times 10^3 \pm 2.2 \times 10^3$	$20 \times 10^2 \pm 11 \times 10^1$	3.33 ± 0.6
Nuggets	$42.2 \times 10^3 \pm 3.3 \times 10^3$	$20.7 \times 10^3 \pm 4.5 \times 10^3$	$14 \times 10^2 \pm 4 \times 10^2$	3.33 ± 0.8
Wings	$60.4 \times 10^3 \pm 10.4 \times 10^3$	$38.5 \times 10^3 \pm 5.4 \times 10^3$	$10 \times 10^1 \pm 7$	79.6 ± 6.2

* N: Number of examined samples

Table (2): Acceptability of chicken meat products samples according to EOSQC (2005)

Samples						Standards	Microorganisms
Breasts		Nuggets		Wings			
N/20	%	N/20	%	N/20	%		
0	0	3	15	0	0	< 100 MPN/g	Coliform
4	20	6	30	4	20	Free	<i>Staph. aureus</i>

Table (3): Mean values of Chemical analysis of (heat treated) chicken meat products and their acceptability according to EOSQC, (2005).

Samples	TVN	TVN < 20 mg/100 g		TBA	TBA < 0.9 mg/kg	
		N/20	%		N/20	%
		Breasts	27.4 ± 2.6		4	20
Nuggets	28.4 ± 1.1	6	30	0.48 ± 0.12	4	20
Wings	27.0 ± 2.1	4	20	0.65 ± 0.14	4	20

4. DISCUSSION

Bacteriological examination of chicken meat products clearly indicated that the chicken wings samples had significantly higher bacterial load than either breast or nuggets, the results in table (1) showed that the mean aerobic *mesophilic* plate count (cfu/g) of examined breast, nuggets and wings was $21.6 \times 10^3 \pm 3 \times 10^3$, $42.2 \times 10^3 \pm 3.3 \times 10^3$ and $60.4 \times 10^3 \pm 10.4 \times 10^3$ nearly similar results was observed in ELHoti, (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 helps 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. Results recorded in table (1) for *psychrotrophic* count were $11.5 \times 10^3 \pm 2.2 \times 10^3$, $20.7 \times 10^3 \pm 4.5 \times 10^3$ and $38.5 \times 10^3 \pm 5.4 \times 10^3$ this increase of the mean values in wings samples may be due to the prolonged storage period rather than the breast and nuggets samples or due to the fluctuations in storage temperatures. Higher values were observed in EL-Shora, (1990) who found that the log mean values of APC and total *psychrotrophic* counts are 7.43 and 6.78 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 (1994). In general, the contamination of chicken meat products with great number of *psychrotrophs* could be attributed to the neglected sanitary measures adapted during intensive preparation, processing, handling and packaging as well as cold storage (Cenci et al., 1990). Furthermore, the contaminated equipments and knives are probably the principle contributing factors to high

psychrotrophic counts of such chicken meat products (Davies and Board, 1998). Data shown in table (1) revealed that the mean values of *staph. aureus* count in examined samples was $20 \times 10^2 \pm 11 \times 10^1$, $14 \times 10^2 \pm 4 \times 10^2$ and $10 \times 10^1 \pm 7$ respectively, lower findings were observed in AL-Dughaym and Altabari (2010); ELHoti, (2011) and Wang et al., (1976) this high count of *staphylococcal sp.* Indicate bacterial contamination during packing and handling by the workers. The mean *coliform* count in chicken breast, nuggets and wings was 3.33 ± 0.06 , 3.33 ± 0.08 and 79.6 ± 6.2 (MPN/g), as illustrated in table (1) it seems to be low due to the effect of freezing which minimize the count of *coliform*. This is in accordance to Hamada, (2012) and James, et al., (1992). Generally, the presence of *coliform* 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 Abdel-Hafeiz, (1999) could not detect it from nuggets. According to the legal requirements of Egyptian Organization for Standardization and Quality Control (EOSQC, 2005), as shown in table (2), 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 el al., (2006). It was clearly evident from the obtained results that only nuggets samples (15%) had *coliform* count above the EOSQC, (2005), while all samples of both breast and wings were accepted. So *Staph. aureus* count considered as an index of the sanitary quality of examined samples. From a food safety perspective, it is recognized

that *Staph. aureus* is an enterotoxin-producing pathogen but that the concentration needs to exceed 10^5 cfu/ml for sufficient toxin to be produced to cause human illness (Hill,1983).

Results achieved in table (3) indicated that the mean values of TVN mg\100g were 27.4 ± 2.6 , 28.4 ± 1.13 and 27.0 ± 2.1 and the mean values of TBA were 0.59 ± 0.04 , 0.48 ± 0.12 and 0.65 ± 0.14 for breast, nuggets and wings respectively. Also, according to Egyptian Organization for Standardization (EOSQC, 2005) for heat treated chicken meat, the percentage of unaccepted samples of our products under investigations was 20, 30 and 20 for TVN analysis and 0, 20 and 20 % for TBA analysis in breast, nuggets and wings sample respectively. Regarding the examined samples, nearly similar results were recorded by Shams El-Din and Ibrahim (1990) and Shedeed (1999).

TVN can be considered as a reliable indicative measure for the quality of various food articles specially chicken and chicken cuts-up. In general, TVN in chicken cuts-up may be increased as the days of storage increased (Reddy et al., 1970). Our results were agreed with those obtained by Hassanin-Fatin and Hassan (2003). Regarding the examined samples, nearly similar results were recorded by Shams El-Din and Ibrahim (1990) and Shedeed (1999).

5. REFERENCES

- Abd EL-Magied, Walaa, K.A. , Hassan, M.A., Shaltout, F.A. , Lamada, Hanan, M. 2009. Occurrence of psychrotrophic pathogens in chicken meat products. M. V. Sci. (Meat hygiene) Thesis, Fac. Vet. Med., Benha Uni.
- Abdel-Haffeiz, E.M. 1999. Application of HACCP system in chicken nuggets to produce safety and high quality products. Alex. J. Vet. Sci. 115 (4).
- AL-Dughaym, A.M., ALtabari, G.F. 2010. Safety and quality of some chicken meat products in AL-Ahsa markets Saudia Arabia .Saudi J. Biol. Sci. J. 17(1): 37- 42.
- Antonova, I., Mallikarjunan, P., Duncan, S.E. 2003. Correlating objective measurements of crispness in breaded fried chicken nuggets with sensory crispness J. Food Sci., 68 (4): 1308-1315.
- APHA, 2001. Compendium of Methods for the Microbial Examination of Foods. 4th ed. American public health association. Washington. DC, USA.
- Cenci, P., Corrodini, L., Vitaioli, M., Rausa, G. 1990. Comparison of the microbiological profile of rural and industrial poultry I. Enterobacteriaceae. Igiene moderna, 94(2):207-211.
- Davies, A., Board, R. 1998. The microbiology of meat and poultry. 1st Ed., Edmundsburg Press, Ltd., Edmunds, London, UK.
- Duffrenne, J., Ritmeester, W., Delfgou, E., Leusden, F., De-Jonge, R. 2001. Quantification of the contamination of chicken and chicken products in Netherlands with salmonella. J. Food Prot. 64(4): 538-541.
- Egyptian Organization for Standardization and Quality Control (EOSQC) 2005. Standard specification No. 3493 for heat treated chicken meat.
- ELHoti, F.A.I. 2011. Effect of batter formulations on the quality of coated chicken meat products. Ph. D. thesis (Meat Hygiene) Vet. Sci. Fact. Of Vet. Med. Cairo Univ.
- EL-Shora, S.E. 1990. Studied on the sanitary status of Kalyobia meat poultry and fish cool stores. M.V.Sci. Thesis (Meat hugiene), Fac. of Vet. Med., Benha Uni.
- Food and Agriculture Organization "FAO" 1980. Manual of food quality control united Nations, Rome, Italy.
- Frazier, W.C., Westhoff, D.C. 1983. Food Microbiology. 3rd edn., Tata McGraw Hill Publ. Co., New Delhi, India.
- Hamada, M.O. 2012. Isolation of some Enteropathogens from retailed poultry

- meat in Alexandria province. Thesis, M. Sci. V. of Vet. Med. Alex. Univ.
- Hashim, E.S.Y. 2003. Aerobic and anaerobic enterotoxigenic bacteria in ready-to-eat food Ph. D. Thesis, Fac. Vet. Med. Benha Univ.
- Hassenin- Fatin, S. and Hassan, M. A. (2003): Chemical indices of incipient deterioration in chicken cut-up products. *Benha V. M. J.*, 14(2): 54-65.
- Hill, B.M. 1983. Enterotoxins-producing *Staphylococcus aureus* isolated from milk and dairy products. *New Zealand. J. Dairy Sci. Technol.* 18:59-62.
- Hoof, D., De zurtr, L., Van Hoof, J., Vandamme, p. 2002. Occurrence and distribution of arcobacter species in poultry processing. *Fac. Vet. Med., Belgium, J. Food Prot.* 65(8): 1233-1239.
- James, W.O., Brewer, R.L.; Prucha, J.C. William, W.O., Parharm, D. R. 1992. Effect of chlorination of chill water on the bacteriological profile of raw chicken carcasses and giblets. *J. Amer. Vet. Med. Assoc.*, 200(1): 60-63.
- Levin, P., Rose, B., Green, S., Ransom, G., Hill, W. 2001. Pathogen testing of ready to eat meat & poultry products collected at federally inspected establishment in the United States 1990 to 1999). *J. food production* 64: 1188-1193.
- Osman, M.S. 1997. Bacteriological evaluation of heated chicken and chicken meat products with special reference to enterotoxigenic *Staphylococci* isolates. *M.V.Sci. Thesis, Fac. Vet. Med., Cairo Univ.*
- Osman, M. S. 2001. Quality assurance of locally dressed broiler's cuts and their products. Ph. D. Thesis. Fac. Vet. Med. Cairo Univ.
- Patton, D. 2005. Convenience trend driving demand for coated food. *food production daily news.* 64713
- Pepe, O., Blaiotta, G., Bucci, F., Anastasia, M., Aponte, M., Villani, F. 2006. *Staphylococcus aureus* and staphylococcal Enterotoxin A. in breaded chicken products: Detection and behavior during the cooking process. *Applied Environ. Microbiol.*, 72(11): 7057-7062.
- Quinn, P.J., B.K. Markey, M.E. Carter, W.J.C. Donnelly, F.C. Leonard , D. Maguire, 2002. *Veterinary Microbiology and Microbial Diseases.* 1st published Blackwell Science ltd.
- Reddy, S., Ilenrickson, R.I., Olson, H. C. 1970. The influence of lactic acid culryres on ground beef quality. *Oklahoma Agri. Experiment station, Stillwater, Oklahoma. J. Food Sci.*, 35-787.
- Sams, A.R. 2001. *Poultry meat processing.* CRC Press, Boca Raton London, New York Washington, D.C.
- Shams EL-Din, M. H. A., Ibrahim, H.M. 1990. Cooking effects on fat and fatty acids composition of chicken muscles. *Die Nahurung*, 34 (3): 207-212.
- Shedeed, N.A. 1999. Evaluation of microwave cooking of chicken meat. *M. V. Sci. Thesis, Fac. of Agri., Cairo Univ.*
- Smith, O.B., Rokey, G.J., Ben-Gera, I. 1985. Extrusion cooking of breading. In *pasta and Extrusion Cooked Foods: Some Technological and Nutritional Aspects'* (1) 166-173
- Sofroni, E., Gary, D.A., Bixing, H., Narelle, F. and, Stuttard, E. 2008. Bacteriological profile of raw, frozen chicken nuggets. *J. Food Prot.* 71(3): 613-615.
- Suderman, D.R. 1983. Application of batters and breadings to seafood. In *Batter and breading* pp. 61-75. D.R. Suderman F.E., Cunningham (eds). Westport: AVI publishing (cited after ELhoti et al., 2011).
- Sunderland, R. 1992. Application of batter and breadings to poultry, sea food, red meat and vegetables. In "*Batter and Breadings in food processing*", Vol. 1, 177-197. K. Kulp and R. Loewe, (eds). AACC press, Saint Paul, MN
- Wang, P.L., Day, E.J., Chen, T. C. 1976. Microbiological quality of frozen fried

chicken products obtained from a retail store. J. Poultry Sci., 55: 1290.
Zaki, Nadia, Y. 1994. Microbiological problems of processing, handling and

storage of poultry meat. M. V. Sci. Thesis, Meat Hygiene, Fac. Vet. Med. Benha Univ.

التقييم البكتيري والكيميائي لبعض منتجات الدواجن المعاملة حراريا

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الملخص العربي

تواجه صناعه منتجات الدواجن المعاملة حراريا كثير من المشاكل الصحية اثناء التصنيع مما يؤثر بصوره كبيره على صحة المستهلك ولتحديد جوده هذه المنتجات تم جمع عدد عشرين عينه من كل من صدور، قطع النجس واجنحه الفراخ الجاهزه للطهي لتقييم جودتها بكتريولوجيا وكيميائيا وقد اظهرت النتائج ان متوسط العدد الكلي البكتيري والبكتريا المحبه للبروده وميكروب العنقودي الذهبي والميكروبات القولونية هو $3 \times 10^3 \pm 21,6 \times 10^3$ ، $2,2 \times 10^3 \pm 11,5 \times 10^3$ ، $1,1 \times 10^1$ ، $20 \times 10^2 \pm 3,33 \pm 0,06$ في عينات الصدور. $4,5 \times 10^3 \pm 20,7 \times 10^3$ ، $4,2 \times 10^3 \pm 3,3 \times 10^3$ ، 4×10^2 ، $14 \times 10^2 \pm 3,33 \pm 0,08$ في عينات النجس و $10,4 \times 10^3 \pm 60,4 \times 10^3$ ، $5,4 \times 10^3 \pm 38,5 \times 10^3$ ، $10 \times 10^1 \pm 7$ ، $6,2 \pm 79,6$ في عينات الأجنحة على التوالي. وبمقارنه النتائج بقيم المواصفه القياسيه المصريه الخاصه بمنتجات لحوم الطيور الداجنه المعامله حراريا وجد ان 20,30 و 20 % من العينات المختبره على التوالي مرفوضه حسب المواصفه لاحتوائها على الميكروب الذهبي العنقودي وكذلك ايضا 15 % من عينات النجس تحتوي على الميكروبات القولونية بأعداد فوق المسموح بها في المواصفه. كما تم قياس تركيز النيتروجين القاعدي المتطاير (مجم / 100 جم) كما يلي $27,4 \pm 2,6$ ؛ $1,13 \pm 28,4$ و $27,0 \pm 2,1$ في العينات المختبره على التوالي ومتوسط حمض الثيوباربيتيورك (مجم/كجم مالونالدهيد) كالاتي $0,04 \pm 0,59$ ؛ $0,12 \pm 0,48$ و $0,14 \pm 0,65$ في العينات المختبره على التوالي. كما اظهرت النتائج ان عينات صدور الفراخ هي أفضل العينات المختبره قيد الدراسة.

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