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QUALITY ASSESSMENT OF SOME READY-TO-EAT AND LOCALLY PRODUCED CHICKEN MEAT PRODUCTS

(With 7 Tables)

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تقييم جودة بعض منتجات لحوم الدواجن المعدة للأستهلاك والمنتجة محليا

إبراهيم على القويعى

أجريت هذة الدراسة لتقييم جودة بعض منتجات لحوم الدواجن المعدة للأستهلاك والمصنعة محليا. فقد تم جمع عدد ٢٥ عينة عشوائية من كل من ناجتس ولانشون الدجاج من أسواق مدينة دمنهور. أظهرت نتيجة الفحص الظاهرى أن العينات المفحوصة ذات صفات ظاهرية وحسية جيدة. كما أظهرت نتائج الفحص البكتريولوجى أن متوسطات العد الكلى للبكتريا الهوائية والمحبة للبرودة وبكتريا القولون العصوية والميكروب العنقودى الذهبى فى منتج ناجتس الدجاج كانت كالأتى ٨.٢×١٠^{٤} ±١.٢×١٠،٨.٦×١٠^{٤} ، ١.٥×١٠^{٤} ± ٢.٤×١٠^{٢} ، ٨ ×١٠ ± ٠.٦ ×١٠^{٣} ، ١.٥ ×١٠^{٣} بينما كانت مثيلاتها فى عينات اللانشون كالأتي ١.٢×١٠^{٤} ±٠.٩×٥.١٠^{٣}، ١.٢×١٠^{٤} ± ٠.٨٥، ١.٦١ ± ٢.٣ ×١٠^{٣} ± ٨.٥ ×١٠^{٢} على التوالى. وقد بينت الدراسة أن كل عينات الناجتس و ٢٠٪ من عينات اللانشون قد جاوزت بشكل طفيف الحد المسموح به (١٠^{٤} ميكروب/جرام) للبكتريا الهوائية ولم يثبت خلوها من الميكروب العنقودى الذهبى طبقا للمواصفة القياسية المصرية رقم ٣٤٩٣ لسنة ٢٠٠٠ والتعديلات المدخلة عليها فى ٢٠٠٣/١٢/١٦ . بينما لم يتم عزل أى عترات للميكروب القولونى كما لم يتم أكتشاف ميكروب السالمونيلا فى أى منهما. كما بينت نتائج الاختبارات الكيميائية المبينة للجودة أن متوسط تركيز أيون الهيدروجين فى الناجتس ٦.٠٨ ± ٠.٠٤٦ ، وفى اللانشون ٦.١٥±٠.٠٦ ، وكانت قيم المركبات النيتروجينية القاعدية المتصاعدة تتراوح بين ٧.٥٣ و ١٩.٣٥ بمتوسط ١٣.٣٦± ٠.٧٦مجم/١٠٠جم فى عينات الناجتس بينما كانت تتراوح بين ١.٠٨ و ١٣.٩٨ بمتوسط ٥.٥٤ ± ٠.٦٦ مجم/١٠٠ جم فى عينات اللانشون. وبذلك لم تتعدى قيم المركبات النيتروجينية المتصاعدة الحد المسموح به فى منتجات الدواجن (يساوى ٢٥ و ٣٠ مجم/١٠٠جم فى منتجات لحوم الدواجن نصف المطهية وكاملة الطهى على التوالى). هذا وقد سجلت قيم منخفضة جدا لم تتجاوز الحد المسموح به (٠.٩ مجم مالونالدهيد/كجم) لعدد حامض الثيوبربتيورك الدال على أكسدة الدهون ولم ينعكس ذلك على الصفات الحسية لتلك المنتجات.

SUMMARY

50 random chicken meat products (25 of each nuggets and luncheon), which were ready-to-eat and locally produced in Egypt, were collected from supermarkets and minimarkets in Damanhour City to assess their quality. The results of organoleptic and sensory evalution were accepted and all the examined samples were in good condition. The means ± S.E.M. of total aerobic, total psychrotrophic, total coliforms and total *Staphylococcus aureus* in chicken nuggets were: $8.2X10^4 \pm 1.2X10^4$, $8.6X10^4 \pm 1.5X10^4$, $2.4X10^2 \pm 8.0X10$ and $6.0X10^3 \pm 1.5X10^3$ cfu/g, respectively,while in luncheon were : $1.2X10^4 \pm 5.9X10^3$,$1.5\ X10^4 \pm 1.2X10^4$, 5.08 ± 1.61, $2.3X\ 10^3 \pm 8.5X10^2$ cfu/g,respectively. This study mentioned that all nuggets samples and 20% of luncheon samples slightly exceeded the maximum permissible limit for total aerobic counts (10^4 cfu/g) according to Egyptian standard specifications No_s. 3493/2000 and its amendments in 2003 and 1114/2005 of Egyptian Organization for Standardization and Quality Control *"EOSQC"*. Also, samples of both products were not be completely free from *Staphylococcus aureus* but were completely free from *Escherichia coli* and *Salmonellae* as a pathogenic microorganism. The chemical examination revealed that the means ± S.E.M. of hydrogen ion concentrations (pH) were 6.08 ± 0.046 and 6.15 ± 0.06 in nuggets and luncheon, respectively, while total volatile basic nitrogen (TVB-N) ranged from7.53 to 19.35, with a mean±S.E.M. of 13.36±0.76 mg/100g in nuggets and ranged from 1.08 to 13.98, with a mean ± S.E.M. of 5.54 ± 0.66 mg/100g in luncheon. These values of TVB-N were not exceeded the maximum permissible limit, (25&30 mg/100g of half partially cooked and completely cooked poultry meat products, respectively) according to ESS No.3493/2000. The fat oxidation criteria determined by thiobarbituric value in both products were very low to be reflected on the flavour and did not exceeded the permissible limit (0.9 mg malonaldhyde/kg).

Key

INTRODUCTION

Poultry meat has become the second most popular eaten meat due to it is a good source of protein and many nutrients and is relatively low in fat.

The increasing price of meat has encouraged the food processors to produce new meat products available as either fresh or precooked (i.e.fried), in different shapes, easily handled, stored and rapidly used with low costs as luncheon and nuggets. Deep fat frying is a popular

cooking method because it generates flavourful products having crispy exteriors with moist and juicy interiors.

Poultry and poultry products ranked the first or the second in foods associated with diseases in most of the countries all over the world, in the USA ranked the third of the reported food-borne disease outbreaks (Bean and Griffin, 1990).

Chicken products are highly perishable foods, depending on the degree of processing following slaughter, their spoilage varies between 4 and 10 days under refrigeration (Marenzi, 1986). Susceptibility of chicken meat and chicken-based meat products to microbial spoilage presents a potential health hazard due to poultry meat may harbor pathogenic microorganisms (Geornaras *et al.,* 1998). Spoilage is commonly detected by sensory and/or microbiological analysis, in addition to an alternative method involves the measurement of chemical changes associated with the growth of specific spoilage organisms in meat and meat products (Dainty, 1996). In the washing process, poultry haeme removing is important because white meat is more valuable than dark meat (Yang and Froning, 1994). The edible coatings and films applied to food substrates before frying aid to limiting moisture and oil transfer during frying (Albert and Mittal, 2002) and also act as barriers in controlling the transfer of moisture and oxygen, thereby preventing quality deterioration of food products (Mate and Krochta, 1996).

Lipid oxidation is one of the main factors used to estimate meat quality due to the susceptibility of meat and meat products to oxidative degeneration (Morrissey *et al.,* 1998). Fresh and in particular, processed poultry meat products are very susceptible to oxidative deterioration (Higgins *et al.,* 1998b) because they contain a high proportion of polyunsaturated fatty acids (PUFA) (Higgins *et al.,* 1998a). The control of lipid oxidation in fresh and further processed meat products is a goal of food scientists and food processors (Sheldon *et al.,* 1997). The changes in quality incurred by lipid oxidation are manifested by adverse changes in colour, flavour, and nutritive value, and also by the possible production of toxic compounds (Jensen *et al.,* 1998). Adverse changes in colour are not very easily detected in chicken meat. Changes in flavour occur especially in cooked-stored chicken products. Warmed-over flavour, and overall off flavour intensities increased in chicken patties as a result of storage for one or more days after cooking (Ang and Lyon, 1990). In addition, clour deterioration of ground chicken meat has been observed as storage time progressed (Yang and Chen, 1993), in

particular, colour attributes associated with lightness / darkness and redness.

Hence, this study was conducted to assess the quality of some ready-to-eat chicken meat products favoured by most of the consumers in Egypt.

MATERIALS and METHODS

A total of 50 random packaged samples of about 500g of locally processed chicken meat products (25 each of nuggets and luncheon) were collected from different super and mini markets of Damanhour city in summer of 2011. Each sample was wrapped separately in sterile polyethylene bag and transferred directly to the laboratory without delay in an ice box. In the laboratory, the whole surface of each sample was aseptically exposed and a part about 150g for each examination from each sample was put on a sterile plate and the following examinations were performed.

I- Organoleptic and Sensory evaluation:

The samples of chicken nuggets were frozen and luncheon samples were kept refrigerated until sensory evaluation. Each nugget unit was reheated for 4 minutes including time of defrosting and a panel of seven judges familiarized with flavor attributes (off-odor and off-taste) was used for sensory evalution. Acceptability as a composite of odor and taste was estimated using a descriptive scale ranging from 1-9, where1=extreme foreign flavor or dislike intensely and 9=no foreign flavor or like extremely. A score of 6 was taken as the lower limit of acceptability (Penney *et al.,* 1993). Other defects in colour and consistency were noted and recorded.

II-Bacteriological examination:

1. Preparation of samples according to ICMSF (1978):

Ten grams of the prepared sample were transferred to a sterilized homogenizer flask containing 90 ml of 0.1% sterile peptone water. The contents were homogenized at 14000 r.p.m. for 2.5 minutes to provide a dilution of 10^{-1}. The homogenate was allowed to stand for 5 minutes at room temperature, then 1 ml of homogenate was transferred with a sterile pipette into a sterile test tube containing 9 ml of 0.1% sterile peptone water to obtain a dilution of 10^{-2}. Then further decimal ten fold serial dilutions up to 10^{-6} were prepared.

2. Total aerobic bacterial count (APC) according to APHA (1992):

One ml from each dilution was transferred into duplicate sterile Petri dishes and mixed with about 10 ml of sterile plate count agar medium "melted and kept at 45ºC". After solidification, cultivated plates as well as control one were incubated at 37ºC for 48 hours in an inverted position. Average count was calculated as a total aerobic count per gram of sample.

3. Total Psychrotrophic bacterial count according to APHA (1992):

The same steps, as in total aerobic bacterial count, were carried out but the incubation was done at 7ºC for 10 days.

4. Total coliform count (MPN/g):

The multiple tube method recommended by ICMSF (1978) was applied. Most probable numbers (MPN) of coliforms per gram of the examined samples were calculated by using MPN table.

Isolation of Enteropathogenic Escherichia coli (ICMSF, 1978):

One ml from each positive MacConkey broth tube was inoculated to *E.coli* broth. The inoculated tubes were incubated at 44 ± 0.5ºC for 48 hours in thermostatically controlled water bath (Eijkmann test). A loopful from each positive tubes showing gas production was streaked onto plate of Eosine methyline blue agar and incubated at 37ºC for 24 hr.Two typical colonies (greenish metallic with dark purple center with or without sheen) were picked up and inoculated into sterile semisolid nutrient agar tubes for further biochemical identification.

5. Detection and isolation of *Salmonellae* was carried out according to the methods outlined by (AOAC, 1984).

6. Total *Staphylococcus aureus* count (ICMSF, 1978):

0.1 ml from each decimal dilution was spread over the surfaces of duplicate dried Baired Parker agar plates. The inoculated plates were incubated at 37ºC for 48 hours in an inverted position. The black shiny colonies with narrow white margines and surrounded by a clear zone were counted. Suspected colonies were stabbed in semi-solid agar for further morphological and biochemical identification (catalase, mannitol, coagulase, thermostable nuclease production and oxidation-fermentation of glucose).

III- Chemical examination:

1- pH (Hydrogen ion concentration):according to Pearson(1973).

2-Determination of total volatile basic nitrogen "TVB-N" (FAO, 1980): by Conway microdiffusion method.

3- Determination of thiobarbituric acid value (TBA): according to Vyncke (1970).

RESULTS

Table 1: Frequency distribution of the examined chicken products samples according to Organoleptic and Sensory evalution.

	Appearence				Colour				Flavour				Consistency			
	Normal		Abnormal		Normal		Abnormal		Normal		Abnormal		Normal		Abnormal	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Nuggets	25	100	0	0	25	100	0	0	25	100	0	0	25	100	0	0
Luncheon	25	100	0	0	25	100	0	0	25	100	0	0	25	100	0	0

Table 2: Statistical analytical results of the examined chicken products samples (n=25 of each).

Paramter	Nuggets				Luncheon			
	Positive Samples		Mean	S.E.M.	Positive Samples		Mean	S.E.M.
	No.	%			No.	%		
APC(cfu/g)	25	100	8.2×10^4*	1.2×10^4	21	84	1.2×10^4**	5.9×10^3
T. psych. count(cfu/g)	25	100	8.6×10^4*	1.5×10^4	19	76	1.5×10^4**	1.2×10^4
T. coliform count(MPN/g)	25	100	2.4×10^2	8.0 X10	25	100	5.08	1.61
Staph. aureus count(cfu/g)	25	100	6.0×10^3*	1.5×10^3	18	72	2.3×10^3**	8.5×10^2

-No.= Number S.E.M.= Standard error of mean

-Values with the same symbols were significantly correlated at 0.01 level.

Table 3: Statistical analytical results of chemical quality indexes values in examined chicken meat products (n=25 of each).

Index	Nuggets				Luncheon			
	Positive Samples		Mean	SEM	Positive Samples		Mean	SEM
	NO.	%			NO.	%		
pH	-	-	6.08	0.046	-	-	6.15	0.06
TVB-N(mg/100g)	25	100	13.36	0.76	25	100	5.54	0.66
TBA-RS(mg/kg)	25	100	0.038	0.005	25	100	0.028	0.002

Table 4: Frequency distributions of the examined chicken nuggets samples based on their bacterial contamination values.

Range	Total aerobic count			Total Coliforms(MPN)				Total *Staph.aureus* count		
	No. of samples	%	P.L.*	No. of samples	%	P.L.*	E.coli	No. of samples	%	P.L.*
≤10	0	0	10^4	7	28	10	Free	0	0	Free
$\leq 10^2$	0	0		11	44			0	0	
$\leq 10^3$	0	0		3	12			9	36	
$\leq 10^4$	0	0		4	16			13	52	
$\leq 10^5$	16	64		0	0			3	12	
$>10^5$	9	36		0	0			0	0	

*P.L.= maximum acceptable limit according to *Egyptian Standard Specification"E.S.S.",No. 3493/2000* for poultry meat products.

Table 5: Frequency distributions of the examined chicken luncheon samples based on their bacterial contamination values.

Range	Total aerobic count			Total Coliforms(MPN/g)				Total *Staph.aureus* count		
	No.of samples	%	P.L.*	No. of samples	%	P.L.*	E.coli	No. of samples	%	P.L.*
≤10	4	16	10^4	24	96	10^2	Free	7	28	Free
$\leq10^2$	0	0		1	4			3	12	
$\leq10^3$	1	4		0	0			7	28	
$\leq10^4$	15	60		0	0			6	24	
$\leq10^5$	4	16		0	0			2	8	
$>10^5$	1	4		0	0			0	0	

**P.L=maximum acceptable limit according to E.S.S.,No.1114/2005 for luncheon.

Table 6: Frequency distributions of the examined chicken meat products based on their chemical quality indexes values.

Nuggets						Luncheon					
pH			TVB-N			pH			TVB-N		
Range	No.	%	Range	No.	%	Range	No.	%	Range	No.	%
≤5.0	0	0	≤5	0	0	≤5.0	0	0	≤5	11	44
≤5.5	0	0	≤10	7	28	≤5.5	0	0	≤10	11	44
≤6.0	11	44	≤15	7	28	≤6.0	11	44	≤15	3	12
≤6.5	13	52	≤20	11	44	≤6.5	11	44	≤20	0	0
≤7.0	1	4	≤25	0	0	≤7.0	3	12	≤25	0	0
≤7.5	0	0	≤30	0	0	≤7.5	0	0	≤30	0	0

Table 7: Incidence of coagulase positive *Staph. aureus* strains in examined chicken meat products samples (n=25 of each)

Chicken nuggets		Chicken luncheon	
No.of +ve strains	%	No. of +ve strains	%
4	16	12	48

DISCUSSION

Organoleptic and Sensory evalution:

From the summarized results in Table 1, it was shown that all the examined chicken nuggets and luncheon samples were organoleptically accepted.

The level of acceptance of coated products, as nuggets, depended on the coating characteristics such as the general appearance, colour, batter texture and crispness (Parinyasiri and Chen, 1991). The increase in frying temperature directly influenced the colour of the coated fried food to a darker golden brown colour. The colour of the cooked food is influenced by the ingredients composition, cooking method, coating medium and the oil used (Suderman, 1983). The reduction of moisture loss could increase the juiciness of the product, so, with the addition of water-binding agents, much of the added water in low-fat meat products can be retained after cooking. Also, the coated nuggets breaded units contained more pressed juice than the detached ones and the increased juiceness caused the interior substrate to be less tough. To restore juiciness, flavours and mouthfeel that are lost when fat is removed, various functional additives in conjunction with the addition of water are added. Among such additives are starch, dietary fibers, soy, milk proteins and egg solids (Chang and Carpenter, 1997). Fletcher *et al.* (2000) stated that cooked nuggets were lighter and less red than the raw ones, similar to what occurred during breast poultry meat cooking. Marked off-odour was not noticed just at opening of the luncheon packages during sensory evalution, and also, neither greening discolourtion either surface or internal greening (green core) nor browning due to charring of carbohydrate (starch and/or sugar) incorporated in the emulsion by long period of cooking or high temperature or the lack of antioxidant and the further development of denatured metmyoglobin in this cured product (Meat Board, 1983) could not marked. Fading discolourtion may be attributed to use of chicken meat with oxidized fat or addition of fat having high peroxide number resulting in instability of the cured meat colour (Price and Schweigert, 1971), the use of bad grade nitrite or under estimation of it, using meat poor in myoglobin content and/or thawing of frozen chicken meat too long before comminution leading to dripping of myoglobin radical of meat proteins which is readly soluble in water (Meat Board, 1983).

Bacteriological examination:

The results recorded in Table 2 showed that the means ± S.E.values of total aerobic count , total psychrotrophic count, total coliforms count (MPN) and total *Staph.aureus* count in the examined chicken nuggets samples were $8.2X\ 10^4 \pm 1.2X\ 10^4$, $8.6X\ 10^4 \pm 1.5\ X10^4$, $2.4X\ 10^2 \pm 8.0\ X10$ and $6.0X\ 10^3 \pm 1.5X\ 10^3$ cfu/g , respectively. While in chicken luncheon samples were $1.2\ X\ 10^4 \pm 5.9\ X\ 10^3$,$1.5\ X10^4 \pm 1.2\ X\ 10^4$, 5.08 ± 1.61 and $2.3\ X\ 10^3 \pm 8.5\ X\ 10^2$ cfu/g, respectively.

Nearly the same results for APC and total *Staph.aureus* counts were recorded as $14.0\ X10^4$ and $13.7\ X10^3$ by Essa *et al.* (2004). Bkheet *et al.* (2007) studied the microbiological content of the local manufactured poultry meat products in El-Bohira Governorte. They recorded that the means of total mesophilic, total psychrotrophic, total *Staphylococcus auraus* and total coliform counts were $2.5x10^5$; $6.9x10^4$; 41.4±12.2 and $2.1x10^4$ cfu/g in chicken nuggets and were $4.3x10^4$; $6.2x10^3$; 154.4±39.8 and $2.3x10^4$ cfu/g, respectively in chicken luncheon.

Higher APC counts were recorded by El-Khateib *et al.* (1988) "$1X10^6$ cfu/g in chicken luncheon**"** and by El-Tahan *et al.* (2006) who stated that total bacterial count in chicken nuggets collected from Shubra, Down Town and Nasr city were ranged from $14X10^5$ to $47X10^6$ cfu/g, and in chicken luncheon ranged from $91X10^5$ to $8\ X10^7$cfu/g; while total coliforms counts ranged from 0 to $9X10^4$ in nuggets and from 0 to$17\ X10^5$ cfu/g in luncheon and also, the incidences of *S.aureus* isolations ranged from 0 to 33.5% in nuggets, while in luncheon ranged from 0 to100 %.

Tables 4 and 5 illustrated that 100% and 20% of samples of nuggets and luncheon exceeded the maximum permissible limit (10^4) for toal aerobic bacterial count (APC) according to Egyptian Standard Specifications "E.S.S.", No.3493/2000 and No.1114/2005. The incidence of total coliform counts (MPN/g), as a bacterial indicator of fecal pollution, were high in nuggets, where only 28% of the examined samples exhibited satisfactory results (≤10 cfu/g), on the otherside, 100% of the examined luncheon samples not exceeded the permissible limit (10^2 microorganisms/g) according to E.S.S., No.1114/2005.

The high aerobic plate count often indicates contamination of raw material or unsanitary measures during processing (Icmsf, 1978). Also it may be due to unsuitable environmental storage. Most of psychrotrophic bacteria are non pathogenic but their presence in high

numbers may be decrease the keeping quality of the products and makes it unfit for human consumption (Elliott and Michener, 1965). Internal microbial levels in cooked meats depend on the initial microbial levels and types before heating, the thermal process and the subsequent holding-time temperatures. Freshly prepared cooked uncured meats normally have counts of 10^2 or less per gram. During handling, packaging or serving of cooked products, some low level of contamination invariably occurs on the products surfaces from equipments and food handlers. Cooked non fermented cured meats products have counts of 10^3 or less/g; higher levels in products from retail outlets reflect the time-temperture history of the storage. Under proper refrigeration, such meats do not support the growth of mesophilic pathogens, so that high aerobic plate counts are unrelated to health hazard. Coliforms present as unavoidable contaminants at low levels (± 10cfu/g), can grow in refrigerated products if they are psychrotropgic (Johnston and Tompkin, 1992). Jurgeen (1994) estimated that the killing temperature of psychrotrophic bacteria ranged from 60-70°C.

Ranken and Kill (1993) described microbiological quality in terms of microbial count/g, 10^2-excellent quality, 10^4-good commercial quality, 10^6-rejection limit in many commercial conditions, 10^8-meat and meat product smell and 10^9-meat become slimy.

In this study, *E.coli* failed to be isolated from neither nuggets nor luncheon samples. El-Tahan *et al.* (2006) isolated *E.coli* only from both nugget and luncheon samples collected from Down Town retail markets but the samples collected form Shubra and Nasr city were free. *Salmonellae* were not detected in both nuggets and luncheon examined samples and this result agreed with that of El-Tahan *et al.* (2006) and Al-Dughaym and Altabari (2010). This was due to that the heating process destroys *Salmonellae* and other non sporeforming pathogens (Johnston and Tompkin, 1992).

Table **7** showed that 16% and 48% of chicken nuggets and luncheon samples, respectively, were contaminated with coagulase positive *Staph. aureus*. Human contact with cooked food, as in handling and in slicing, invariably adds *S.aureus* at levels of 10 to 10^2 to many of sample units (Surkiewicz *et al.,* 1973). Such levels are harmless but offer sufficient inoculum for growth to hazardous levels if subsequent conditions of time-temperture abouse occur (Johnston and Tompkin, 1992).

Studies indicated that large numbers (usually greater than 1 million cfu/g) of coagulase positive *Staph. aureus* must contaminate the

food for producing sufficient enterotoxin to cause food poisoning (Liston *et al.,* 1971; Gilbert *et al.,* 1972). Cooked cured luncheon meats seldom cause staphylococcal food poisoning because *S.aureus* does not grow as well anaerobically in the presence of salt and nitrite (luncheon meats are usually vacuum packaged). Moreover, *S.aureus* competes poorly with the lactic acid bacteria that dominate in vacuum-packaged cured meats and will not grow below 6.7ºC "luncheon meats are usually well refrigerated" (Johnston and Tompkin, 1992).

The biofilm formation in food processing plants is mainly associated with damp surfaces, on which the microorganisms can easily aggregate (Chmielewski and Frank, 2003). Some bacteria (such as in genera Klebsiella, Pseudomonas and Staphylococcus) produce exopolymers that can fix additional microorganisms firmly attached to the surface, these can survive in form of mixed biofilms (Sasahara and Zottola, 1993). Both pathogenic and food spoilage microorganisms have been isolated from such bacterial communities. It was also found that *Listeria monocytogenes* and *Enterobacter aerogenes* or bacteria of the genera Bacillus, Streptococcus, Staphylococcus, Shigella, Escherichia, and Klebsiella survived cleaning and disinfection (Austin and Bergeron, 1995; Sharma and Anand, 2002; Gunduz and Tuncel, 2006). Bacteria which survive in the biofilms on surfaces are much more resistant to biocidal agents than planktonic cells of the same species (Carpentier and Cerf, 1993; Campanac *et al.,* 2002). Due to this fact, the conventional sanitation and disinfectant agents may fail to kill bacteria under certain conditions (Hodd and Zottola, 1997). Moreover, it was found that the cell-to-cell DNA transmission occurs in a micro-community, and the biofilm development can be stimulated by their conjugation mechanism (Molin and Tolker–Nielsen, 2003).

Chemical examination:

Table 3 showed that the means ± S.E.values of pH, TVB-N (mg/100g) and TBA(mg/kg) in the examined nuggets samples were 6.08 ±0.046; 13.36± 0.76 and 0.038 ± 0.005, respectively, while in luncheon samples were 6.15± 0.06 ; 5.54 ±0.66 and 0.028± 0.002, respectively.

Nearly similar results were recorded by Daoud *et al.* (2001) who analysed chicken luncheon for keeping quality parameters. They found that the mean values of of pH, TBA and TVB-N were 6.07, 0.124 mg/kg and 13.0 mg/100g; respectively. Higher results were obtained by Fath El-Bab and Sayed-Eman (2005) who collected thirty chicken luncheon samples from different governorates (Cairo, Giza, Zagazig, Alexandria and Beni Suef) and they found that the

thiobarbituric acid value ranged from 0.62 to 0.86 with a mean ± S.E. of 0.73±0.02mg malonaldehyde/kg which were within the permissible limit (0.9 mg malonaldehye/kg) as recommended by Egyptian Organization for Standardization and Quality Control "EOSQC" (1995).

Al-Dughaym and Altabari (2010) examined the further processed poultry meat products in Al-Ahsa markets-Kingdom of Saudi Arabia. Nuggets showed a high TBA values which varied from 0.53 to 2.09 mg malonaldhyde/kg, with a detectable unacceptable flavour and lower degree of acceptability. While pH and TVB-N values varied from 5.87 to 6.03 and from 13.5 to 15.4 mg TVB-N /100g, respectively, according to manufacture companies.

Hammad-Manal (2005) recorded similar results for the pH and TVB-N in chicken luncheon which were ranged from 6.0 to 6.99 and 12.37 to 15.71mg/100g, with means ± S.E of 6.23±0.03 and 14.15±0.14mg/100g but the TBA values were higher and were ranged from ranged from 0.19 to 0.63 mg malonaldehyde/kg, with a mean ± S.E. value of 0.42 ± 0.02 mg/kg, respectively.

Table 6 showed that the examined samples of nuggets and luncheon exhibited slightly increased pH values (>6.5-<7) in about 4% and 12%, respectively. Also, the TVB-N values in all the examined samples of both products types were completely complied with the E.S.S.,No.3493/ 2000 for poultry meat products and its amendments in 16/12/2003. The maximum permissible limits were 25 and 30 mg TVB-N /100g for partially and completely cooked poultry meat products.

The final pH of pasteurized cured meat products depends largely on the initial pH of the meat which ranges from 5.6 to 6.4. The inclusion of polyphosphates may increase the pH by 0.3, and the final pH after processing may vary between 6.1 and 6.5 (Ingram and Simonsen, 1980).

The increase in pH might be due to the addition of phosphates in the formulation,the addition of whole egg liquid (pH 7.83) in nuggets. Also, an increase in pH was observed after frying,this is in agreement with other studies on poultry restructured meat products (Polanne *et al.,* 2001; Jimenez-Colmenero *et al.,* 2003) and breast poultry meat (Allen *et al.,* 1998) and it could be attributed to the formulation and/or the protonation of some basic amino acids residue side chains which became exposed due to the protein denaturation during cooking (Xiong *et al.,* 1999).

The formation of TVB-N is related mostly to the degradation of animal protein, i.e.deamination of protein during spoilage that begins as

a result of the growth of proteolytes. So, it could be used as criterion for the detection of spoilage (Vyncke, 1980).

The results illustrated in Table 3 showed that the ranges of TBA values in both nuggets and luncheon obeyed the allowable permissible level (<0.90mg/kg as malonaldhyde) according to E.S.S., No.3493/ 2000 for poultry meat products and its amendments in 16/12/2003 for coated and non coated poultry meat products.

These lower values of TBA in the investigated chicken meat products may be attributed largely to the absence of oxygen which is the most critical factor influencing lipid oxidation, using freshly slaugltered chicken broilers meats, increasing inhibition of meat enzymes by incorporation of sodium chloride and nitrite and the efficient removing of heme pigments during bleeding and washing techniques. Membrane-bound lipids consist largely from polyunsaturated phospholipids which are especially susceptible to lipid oxidation (Asghar *et al.,* 1988). Polyunsaturated fatty acids (PUNA) such as linoleic and arachidonic acids, undergo the greatest oxidation in red meats and poultry during frozen storage (Lai *et al.,* 1991). Studies dealing with nonenzymatic catalysts of lipid oxidation in meat and meat products have focused on iron compounds, including haeme pigments, free iron and ferritin (Monahan *et al.,* 1993). The presence of antioxidants as vitamine E which act as free radical scavengers (Monahan *et al.,* 1992). Washing techniques for mechanically deboned poultry meat have been investigated because of the advantages of removing fat, haeme pigments and other water soluble compounds (Yang and Fronging, 1992). Pearson *et al.* (1983) stated that the oxidation products of lipids are chronic toxicants in man and contribute to the aging process, cancer and cardiovascular diseases.

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