MICROBIOLOGICAL EVALUATION OF FROZEN CHICKEN NUGGETS AND STRIPS

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ABSTRACT

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 $5.8 \times 10^3 \pm 1.2 \times 10^2$; $3.4 \times 10^2 \pm 3.8 \times 10$; Aerobic spore forming count were $2.7 \times 10^3 \pm 1.2 \times 10^2$; $4.9 \times 10^3 \pm 7.8 \times 10^2$, The identified aerobic spore forming bacteria were *B.subtilis, B.cereus, B. sterothermophilus, B. lents* and *B. coagulans* . The mean value of mould and yeast counts were $6.5 \times 10 \pm 1 \times 10$; $5 \times 10^2 \pm 1.4 \times 10$, The identified mould genera were Alternaria, Cladosporium, Rhizopus, Aspergillus , Fusarium , pencillium , Mucor ,The Aspergillus and Penicillium genera were identified. The identified yeast genera were Rhodotorula, Deparomyces, Saccharomyces, Candida, Endomyces, Pichia, and Cryptococcus. The mean value of MPN/g. of Coliforms were $1.1 \times 10 \pm 0.3 \times 10$; $3.8 \times 10 \pm 0.3 \times 10$,The Incidence of identified Enterobacteriaceae organisms were *E.coli* 5(10.6%), 7(23.3%) *K. pneumoniae* 3(6.3%), 1(3.3%), *C. diversus* 1(2.1%), (0%), *C. freundii* 11(23.4%), 3(10%), *p. mirabilis* 9 (19.1%) , (0%), *p. vulgris* (0%) , 2(6.6%), *serratia marcescens* 7 (14.9%),4(13.3%), *Morgenalla morganii* 5(10.6%) , 6(20%), *Enterobacter aerogenes* (0%) , 4(13.3 %), *Enterobacter agglumerans* 4(8.5%),(0 %), *Edwardsiella tarda* 1(2.1%) , 3(10%), Shigella spp.(0%) , (0%) and salmonella spp. 1(2.1 %) , (0%), respectively. The isolated serotype of *E.coli* were *E.coli* O_{103}: k- 3(12%), 3(12%) and E.coli O_{119}: K_{69} 2(8%), 4 (16 %).The isolated serotype of salmonella organisms were *S. pullorum gallinarum* 1(4%), (0%) respectively. In all examined samples the *clostridium perfringens* couldn't be detected.

INTRODUCTION

Chicken nuggets and strips are liable to be contaminated with different kinds of microorganisms such contaminants may be of public health hazard to consumer. The majority of food borne illness result from the under cooking of raw animal products, which allows pathogenic bacteria to survive and cause illness when ingested. ***Teo et al., (1996); Noha and Gehad (2005)*** ***.El Hoti (2006)*** examined chicken nuggets and fingers bacteriologically and found that both coat and meat of them had noticeably high bacterial counts and were contaminated with various food-borne pathogens.

ICMSF (1980) *and* ***National academy of sciences (1985)*** reported that salmonella and *staphylococcus aureus* organisms were commonly found on row poultry throughout the world and inadequate cooking or cross-contamination could account for their presence in ready-to-eat poultry meats.

Dominguez and Schaffner (2009) recorded that frozen chicken products have been identified recently as a cause of Salmonellosis. At least eight Salmonellosis outbreaks from 1998 to 2008 have implicated in undercooked frozen chicken nuggets, strips, and entrees as infection vehicles. Thus, the presence of Salmonella in frozen poultry products may pose an infection risk if the product is improperly cooked. Mould and yeast contamination of meat and meat products may occur during slaughtering of the animals or birds, transportation, or during further processing of meat products through the use of contaminated equipments or contaminated additives and spices which considered the most important source of mould contamination in meat products ***Scott and Kennedy (1973), Flanniga and Hui (1976), Misra (1981) and Abdel-Rahman (1987).*** Moreover, sensory deviation may occur in addition to increase microbial, biological and toxicological contamination resulted from the use of avian skin and mechanically deboned poultry meat in the formulation of the Egyptian meat products ***Emara and Nouman (2003).***

Although some mould species are beneficial and used in the industrial purposes as in ripening of certain types of meat products, other are saprophytic and largely concerned with the decomposition of organic matter and decay of meat products. The senesces of lipase enzyme by many species of moulds particularly *Aspergillus* and *Penicillium* may cause hydrolysis and decomposition of fat which lead to sever economic losses ***Frazier (1976).*** Also several species of moulds are responsible for production of toxic metabolites (mycotoxins) which hazard human and animal health ***Gracey (1981).***The objective of this study is to determine the microbial quality of frozen chicken nuggets and strips.

MATERIALS AND METHODS

The methods applied in bacteriological indices were carried out as recommended by **APHA,*(1992)*, ICMSF, *(1978) Beerens et al., (1980) and Quinn et al., (1994)*.** While for Total Mould and Yeast Counts were determined according to ***ARX Von (1967)***. The genus *Aspergillus* was identified according to ***Rapper and Fennel (1965) and Samson (1979),*** the genus *Penicillium* according to ***Rapper and Thorn (1949)*** and other mould genera according to ***ARX Von (1967)***. The yeast genera were identified according ***Deak and Beuchat (1996).***

RESULTS & DISCUSSION

The results given in table (1&2) revealed that the mean values of TAPC (cfu/g) in frozen chicken nuggets and strips were $1.9 \times 10^5 \pm 4.7 \times 10^4$; $7.4 \times 10^4 \pm 1.8 \times 10^4$, respectively. The obtained results is lower than those recorded by ***El- Tahan (2006); El- Bassuony (2008); Al-Dughaym and Altabari (2010),*** and nearly similar to those recorded by ***Mukprasirt et al., (2001); Osman (2001); El Hoti (2006); Bkheet et al., (2007); Eglezos et al., (2008)*** but higher than that recorded by ***Othman (1997); Noha and Gehad (2005)*** *and* ***Qoboory(2008).*** The mean value of Enterobacteriaceae count in frozen chicken nuggets and strips were $7.7 \times 10^2 \pm 2.1 \times 10^2$; $1 \times 10^2 \pm 1.3 \times 10$, respectively. The obtained results are lower than those recorded by ***Mohamed (1996)*** but higher than that recorded by ***Hefnawy and Moustafa (1990); Bkheet et al., (2007).*** The mean value of *Staphylococcus aureus* count in frozen chicken nuggets and strips were $5.8 \times 10^3 \pm 1.2 \times 10^2$; $3.4 \times 10^2 \pm 3.8 \times 10$ respectively. The obtained results is higher than those recorded by ***Noha and Gehad (2005); El-Tahan (2006); Al-Dughaym and Altabari*** **(2010)** but nearly similar to those that recorded by ***Othman (1997); El-Dosoky (2004); El Hoti (2006).*** The mean value of Aerobic spore forming count in frozen chicken nuggets and strips were $2.7 \times 10^3 \pm 1.2 \times 10^2$; $4.9 \times 10^3 \pm 7.8 \times 10^2$, respectively. The obtained results is lower than those recorded by ***El-Dosoky (2004)*** but nearly similar to those that recorded by ***Nassif (1996); Mira and Abouzied (2006).*** Frequency distribution of identified aerobic spore forming bacteria in the examined frozen samples of chicken nuggets and strips were *B.subtilis* 14 (40%), 9 (36%); *B.cereus* 11(31.4%), 13 (52%); *B. sterothermophilus* 7(20 %), 2(8%); *B. lents* (0%), 1 (4%); *B. coagulans* 3(8.6), (0%) respectively.

The mean value of mould and yeast count in frozen chicken nuggets and strips were $6.5 \times 10 \pm 1 \times 10$; $5 \times 10^2 \pm 1.4 \times 10$, respectively. The frequency percentage of

identified mould genera in frozen chicken nuggets and strips were Alternaria 44(20.7%) , 30(21.3%) ; Cladosporium 35 (16.4%), 20 (14.2%); Rhizopus 5 (2.3%), 3 (2.1%); Aspergillus 59 (27.7%), 43 (30.5%); Fusarium 10 (4.7%), 2 (1.4%); pencillium 45 (21.1%), 38 (27%); Mucor 15 (7%), 5 (3.5%) respectively.

The frequency distribution of Aspergillus in frozen chicken nuggets and strips were *A. flavus* 10 (16.9 %), 11(25.6%); *A. fumigatus* 12(20.3%) ,10(23.3%) ; *A. niger* 12(20.3%) , 8(18.6%); *A. terreus* 11(18.6 %), 6(14 %); *A. oryazae* 9(15.3%) , 5(11.6%) and A. versicolor 5(8.5%) , 3(7%) respectively.

The frequency distribution of Penicillium in chicken nuggets and strips were P. cyclopium 20(44.4%), 15 (39.5%); P. veredicatum 15 (33.3%), 13 (34.2%) and P. chrysogenum 10(22.2%), 10(26.3%) respectively. The Frequency percent of identified yeast genera in the examined Frozen chicken Nuggets and Strips were Rhodotorula 20 (20.40%), 10 (20.40%); Deparomyces 17(17.35%), 9(18.4%); Saccharomyces 17(17.35 %), 8 (16.3 %); Candida 15 (15.31 %), 8 (16.3 %);Endomyces 12(12.24 %) , 7 (14.3%); Pichia 9 (9.18 %),5 (10.2%); Cryptococcus 8(8.17%), 2(4.1%), respectively. The mean value of MPN/g. of Coliforms in frozen chicken nuggets and strips were $1.1 \times 10 \pm 0.3 \times 10$; $3.8 \times 10 \pm 0.3 \times 10$, respectively. The obtained results is lower than those recorded by ***El-Dosoky (2004); El Hoti (2006); Bkheet et al., (2007); El- Bassuony*** **(2008)**; nearly similar to those that recorded by ***Othman (1997); Eglezos et al., (2008).***

The Incidence of isolated Enterobacteriaceae organisms among frozen chicken nuggets and strips *E.coli* 5(10.6%), 7(23.3%) *K. pneumoniae* 3(6.3%), 1(3.3%), *C. diversus* 1(2.1%), (0%), *C. freundii* 11(23.4%), 3(10%), *p. mirabilis* 9 (19.1%) , (0%), *p. vulgris* (0%) , 2(6.6%), *serratia marcescens* 7(14.9%) , 4(13.3%),*Morgenalla morganii* 5(10.6%),6(20%), *Enterobacter aerogenes* (0%), 4(13.3%), *Enterobacter agglumerans* 4(8.5 %), (0 %), *Edwardsiella tarda* 1(2.1%) , 3(10%),Shigella spp. (0%),(0%) and salmonella spp. 1(2.1%) , (0%), respectively. The isolated serotype of *E.coli* in chicken nuggets and strips were *E.coli* O_{103}: k- 3(12%), 3(12%) and E.coli O_{119} : K_{69} 2(8%), 4 (16 %), respectively. a significant public health importance where the diarrhoeal disease is a major cause of illness and death among infants and young children worldwide ***Frenzen et al., (2005); Amela et al.,(2009).*** The isolated serotype of salmonella organisms among chicken nuggets and strips were *S. pullorum gallinarum* 1(4%), (0%)

respectively. The presence of salmonella species in the products reflects the degree of sanitation in the processing plant and will harm the consumer health as Salmonellosis caused by S. pullorum has also been reported in humans ***Savage and Darre (2008); Saif et al., (2003).*** In all examined samples of frozen chicken nuggets and strips, the *clostridium perfringens* couldn't be detected. which agree with the ***E.S,(2005 – 3493) ; Mukprasirt et al., (2001); El-Tahan (2006)*** not agree with ***Kessel et al., (2001)*** who could detect *CL. Perfringens* with 21% .

Table (1): Microbiological indices of frozen chicken Nuggets.

Microbiological indices	Min	Max	Mean	S.E.
Total Aerobic Plate Counts	1.2×10^4	7.4×10^5	1.9×10^5	4.7×10^4
Enterobacteriaceae counts	1.3×10^2	4×10^3	7.7×10^2	2.1×10^2
Staphylococcus aureus counts	1.3×10^2	6.2×10^3	5.8×10^2	1.2×10^2
Aerobic spore forming Counts	1.1×10^3	3.2×10^4	2.7×10^3	2.7×10^3
Moulds and yeast counts	1.3×10	5×10^2	6.5×10	1×10

Table (2): Microbiological indices of frozen chicken Strips

Microbiological indices	Min	Max	Mean	S.E.
Total Aerobic Plate Counts	2×10^2	4.3×10^5	7.4×10^4	1.8×10^4
Enterobacteriaceae counts	4×10	5.8×10^2	1×10^2	1.3×10
Staphylococcus aureus counts	6×10	5.5×10^3	3.4×10^2	3.8×10
Aerobic spore forming Counts	1×10^2	2.6×10^4	4.9×10^3	7.8×10^2
Moulds and yeast counts	2×10^2	1×10^3	5×10^2	1.4×10

Table (3): Incidence of isolated Enterobacteriaceae species in examined frozen chicken nuggets and strips

Microorganisms	Frozen Nuggets		Frozen Strips	
	No.	%	No.	%
Escheichia coli	5	10.6	7	23.3
Klebsiella pneumoniae	3	6.3	1	3.3
Citrobacter diversus	1	2.1	-	-
Citrobacter freundii	11	23.4	3	10
Proteus mirabilis	9	19.1	-	-
Proteus vulgaris	-	-	2	6.6
Serratia marcescens	7	14.9	4	13.3
Morgenalla morganii	5	10.6	6	20
Enterobacter aerogenes	-	-	4	13.3
Enterobacter agglumerans	4	8.5	-	-
Edwardsiella tarda	1	2.1	3	10
Shigella spp.	-	-	-	
Salmonellae spp.	1	2.1	-	-
Total	**47**	**100**	**30**	**100**

Table (5): Serotypes of E.coli and salmonella in chicken nuggets and strips.

Serotypes	Frozen Nuggets		Frozen Strips	
	No.	%	No.	%
E.coli O_{103}: k.	3	12	3	12
E.coli O_{119} : K_{69}	2	8	4	16
S. pullorum gallinarum	1	4	0	0

Table (6): Conformity of the microbiological indices of frozen Chicken Nuggets with the Egyptian Standardization (ES: 2005 – 3493).

Microbial indices	E.S. limit	Within limit		Exceed limit	
		No.	%	No.	%
Aerobic plate counts	$< 10^4$	0	0	25	100
Enterobacteriaceae counts	$< 10^2$	7	28	18	52
Staphylococcus aureus Counts	0	11	44	14	56
Aerobic spore forming counts	$< 10^2$	0	0	25	100
Mould and yeast counts	0	16	64	9	36
Cl. Perfringens	0	25	100	0	0
E. coli	0	7	28	18	52
Salmonella .spp	0	24	96	1	4

Table (7): Conformity of the microbiological indices of examined frozen Chicken Strips with the Egyptian Standardization (2005 – 3493).

Microbial indices	E.S. limit	Within limit		Exceed limit	
		No.	%	No.	%
Aerobic plate counts	$< 10^4$	12	48	13	52
Enterobacteriaceae counts	$< 10^2$	14	56	11	44
Staphylococcus aureus	0	13	52	12	48
Aerobic spore forming counts	$< 10^2$	0	0	25	100
Mould and yeast counts	0	14	56	11	44
Cl. Perfringens	0	25	100	0	0
E. coli	0	10	40	15	60
Salmonella spp.	0	25	100	0	0

CONCLUSION:

From the above results we can concluded that the chicken nuggets and strips were subjected to contamination during processing; from the raw materials or unsanitary measuring during manufacturing , also it may be due to unsuitable environmental condition during storage. The large percent of samples which are not conformed to the Egyptian standards reflect the unsatisfactory hygienic standard and the quantity and quality of additives used during processing of Chicken Nuggets and Strips.

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الملخص العربى

دراسات على صلاحية بانية و ناجتس الدجاج المجمد

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تم جمع 50 عينة من ناجتس وبانية الدجاج المجمد (25 من كل نوع) حيث تم تقييم المنتج بالفحص الميكروبيولوجى, وكان متوسط العدد الكلى للبكتريا الهوائية فى ناجتس و بانية الدجاج المجمد $1.9 \times 10^5 \pm 4.7 \times 10^4$ ؛ $7.4 \times 10^4 \pm 1.8 \times 10^4$ و متوسط العدد الكلى للميكروبات القولونية $7.7 \times 10^2 \pm 2.1 \times 10^2$ ؛ $1 \times 10^2 \pm 1.3 \times 10^2$ و متوسط العدد الكلى لميكروب العنقود الذهبى $5.8 \times 10^3 \pm 1.2 \times 10^2$ ؛ $3.4 \times 10^2 \pm 3.8 \times 10^2$ و متوسط العدد الكلى للبكتريا الهوائية المتجرثمة $2.7 \times 10^3 \pm 1.2 \times 10^2$ ؛ $4.9 \times 10^3 \pm 7.8 \times 10^2$على التوالى. كانت النسبة المئوية لعزل البكتريا الهوائية المتجرثمة كالتالى باسيلس ساتلس 14(40٪)، 9(36 ٪) ؛ باسيلس سيريس 1(31.4٪)، 13(52 ٪)؛ باسيلس ستيروثيرموفيلس 7 (20٪)، 2(8 ٪)؛ باسيلس لينتس(0٪)، 1(4 ٪)؛ باسيلس كواجيلنس

3 (8.6٪)،(0 ٪) على التوالى. كان متوسط العدد الكلى للفطريات والخمائر 6.5 × 10 ± 1 × 10؛5 × 10 ^{2} ± 1.4 × 10 على التوالى.

امكن عزل 213 عترة تنتمى الى 7 انواع من الفطريات هى ألتيرنيريا 44(20.7٪)، 30 (21.3 ٪) ؛ كلادوسبوريم 35(16.4٪)، 20(14.2 ٪)؛ ريزوبس 5(2.3٪)، 3(2.1 ٪)؛ اسبيرجلس 59 (27.7٪)، 43(30.5 ٪)؛ فيوزاريم10(4.7٪) ، 2(1.4٪) ؛ بينسليوم45(21.1٪) ، 38(27 ٪)؛ ميوكر15 (7٪) ، 5 (3.5 ٪). كانت نسبة جنس الاسبرجيلس موزعه كالتالى اسبرجيلس فلافس 10 (16.9٪) ، 11 (25.6 ٪)؛ اسبرجيلس فيوميجيتس 12 (20.3٪) ، 10 (23.3 ٪)؛ اسبرجيلس نيجر 12(20.3٪) ، 8 (18.6 ٪)؛ اسبرجيلس تيريس 11(18.6٪)، 6 (14 ٪)؛ اسبرجيلس اوريازى 9 (15.3٪) ، 5 (11.6 ٪)؛ اسبرجيلس فيرزيكلر 5 (8.5٪) ، 3 (7 ٪). كانت نسبة البنسليوم موزعه كالتالى بنسليوم سيكلوبيوم 20 (44.4٪)، 15 (39.5 ٪)؛ بنسليم فيرديكاتوم 15 (33.3٪)، 13 (34.2 ٪)؛ بنسليوم كريزوجينم 10 (22.2٪)، 10 (26.3 ٪) على التوالى.

امكن عزل 98 عترة من الخمائر تنتمى الى رودوتريولا 20 (20.4٪)، 10 (20.4 ٪)؛ ديبروميسيز 17 (17.35٪)، 9 (18.4 ٪)؛ سكاروميسز 17(17.35٪)، 8 (16.3٪)؛ كانديدا 15(15.31٪) ، 8 (16.3٪)؛ ايندوميسز 12 (12.24٪) ، 7 (14.3٪)؛ بيشيا 9(9.18٪) ، 5(10.2 ٪)؛ كريبتوكوكس 8 (8.17٪)، 2 (4.1٪) على التوالى. كان متوسط العد الاكثر احتمالية للميكروبات القولونية (MPN /g) 3.6 × 10 ^{2} ± 0.9×10 ^{2} ؛ 2.7 × 10 ^{2} ± 0.3×10 ^{2} على التوالى. تم عزل الميكروبات القولونية بالنسب الاتية ايشريشيا كولى 5 (10.6٪) ، 5 (10.6 ٪)؛ كليبسيلا نيمونيا 3 (6.3٪)، 1 (3.3 ٪)؛ سيتروبكتر دايفرسس 1 (2.1٪) ،(0٪)؛ سيتروبكتر فريندى11 (23.4٪) ، 3 (10 ٪)؛ بروتيس ميرابيلس 9 (19.1 ٪) ،(0٪)؛ بروتيس فالجريس (0٪)، 2(6.6 ٪)؛ سيراتيا مارسينس7 (14.9٪)، 4 (13.3 ٪)؛ مورجينيلا مورجانى5 (10.6٪)، 6 (20٪)؛ انتيروبكتر ايروجينز (0٪)، 4 (13.3 ٪)؛ انتيروبكتر اجلوميرنز4 (8.5٪)،(0 ٪)؛ ادوردسيلا تاردا 1(2.1٪)، 3 (10 ٪)؛ شيجلا (0٪)،(0٪)؛ سالمونيلا 1(4٪)،(0 ٪) على التوالى. تصنيف الايشريشيا كولاى .k : O_{103} بنسبة 3 (12٪)، 3 (12 ٪)؛ O_{119}:k_{69} بنسبة 2 (8٪)، 4 (16 ٪) على التوالى. تم عزل سالمونيلا باللورم جالينيرم بنسبة 1(4٪)، (0٪) على التوالى.