MICROBIOLOGICAL EVALUATION OF SOME CHICKEN MEAT AND MEAT PRODUCTS

LAMADA, HANAN M.[1], MARIONETTE Z. NASSIF[2] and NESREEN Z. ELEIWA[1]

1- Animal Health Research Institute Tanta
2- Animal Health Research Institute , Banha provincial lab.

Abstract

One Hundred random samples of chicken meat products (shieshtawook and pattie) and meat products (Scallop and salami) were collected from different supermarkets in Kalubia andGharbia governorates (25 of each) and subjected to bacteriological and mycological examinations. The result of bacteriological examination proved that the mean values of total Aerobic Plate Count (APC), Enterobacteriaceae count and Staphylococcal count were 2.29 × 106 ± 0.36×106,8.61×103±1.95× 103 and 5.42×104 ± 1.08×104 for shieshtawook samples,7.64×105 ± 2.10×105, 2.76× 103 ± 1.47×103 and 1.13×104 ± 0.24×104 for pattie samples,2.08 ×105 ± 0.52×106, 9.96×102 ± 2.37×102 and 3.34×103 ± 0.60×103 for scallop samples and 4.88×105± 0.48 ×105, 4.18×104 ± 1.48×104 and 6.58×103 ± 2.15 ±103 for salami samples, respectively.Enteropathogenic E.coli were isolated from 24%, 12%, 8% and 8% of examinedshieshtawook, pattie , scallop and salami samples, respectively, also, Salmonella species were isolated only from 8% and 4% of shiehtawook and pattiesamples,respectively. Mean values of total mould count were 2.43×104±1.32×104, 4.06×103 ±1.43×103, 1.63×104 ± 0.88×104 and 1.18×104 ± 0.42×104 in shieshtawook, pattie, scallop and salami samples, respectively and the most frequently encountered moulds were Aspergillus species. On the other hand, the incidence of toxigenic strains of Aspergillusflavus isolated from examined samples was 8%,8%and 16% for shieshtwook, scallop and salami samples, respectively. Also, Aflatoxins B1 and B2 were produced from cultivated toxigenic strains on the media at different levels. The hazardous effects of isolated bacteria and mould strains as well as recommendations to improve the quality of these products were discussed.

INTRODUCTION

Ready to eat meat products are highly demanded for their high biological value, reasonable price, agreeable taste and easily serving.Meat products are considered as an excellent sources of high quality protein, minerals and vitamins (WHO, 1984 and Mosupy et al.,1998).

Meat poultry products play an important role in filling the gap of protein deficiency and they can be considered the best choice in solving the human nutritional problems (Stephan et al.,2003).

Microbiological food safety and food borne infections are important public health concern worldwide.There have been a number of food borne illnesses resulting from the ingestion of contaminated foods such as chicken meat . Most of the pathogens that play a role in food borne diseases have a zoonotic origin (Busani et al.,2006).Insufficient cooking may result in survival of E.coli and subsequently causes food poisoning to consumers (Belongia etal.,1991).Also enteropathogenicE.coli are well recognized as a cause of infantile diarrhea and /orgastrointestinal illness in adult human(Woodenburn and Raab, 1997).

A wide range of food has been implicated in food borne Salmonellosis. However,as the disease is primarlyzoonotic , food of animal origin has been consistently implicated as the main source of human salmonellosis (FAO/WHO,2002).Consumption of food contaminated with Salmonellae can cause salmonellosis; one of the most common bacterial food borne illness(FSIS,2003) . Staph.aureus plays a great role as a bacterial contamination of cooked meat during preparation and processing of cooked meat that may be eaten without sufficient cooking or heating (Soliman,1988).Meat wasconsidered an ideal media for mould growth as it has an optimum pH (5.6 -6.7),high water content (aw = o.99), rich supply of nitrogenous substance and a source of carbohydrate (Coni, etal.,1994). Some mould species could be apublic health hazard because they have the ability to produce mycotoxins (Scheurlen, 1996). In this respect, some Aspergillus species have receiveda great attention as they can produce aflatoxins which have carcinogenic effects (Montagana ,etal., 2004) . Therefore the aim of this work is to evaluate some meat and chicken products from bacteriological and mycological aspects beside, discussion of health hazards effects of the isolated organisms.

MATERIALS AND METHODS

1- Material

One hundred random samples of chicken and meat products (50 of each). Chicken meat samples were shieshtawook and pattie (25 of each) and the meat sample were scallop and salamy (25 of each). Samples were collected from different supermarkets at El-kalubia and El-Gharbia Governorates,the collected samples were frozen and transferred in their original packages directly to the laboratory in an insulated ice box under a complete septic conditions to be examined bacteriologically and mycologically.

2- Method

A- Preparation of samples for microbiological examination according to APHA (2001).

B- Bacteriological examination of chicken and meat products samples:

1-Determination of APC according to APHA(2001).

2-Determination of total Enterobacteriaceae count according to APHA(2001).

3- Isolation and identification of E.coli according to FDA(2002) .

4- Determination of total Staphylococcal count and isolation of S.aureusaccording to FDA(2002).

5- Isolation and identification of Salmonellae according to ISO 6579 (2002).

C- Mycological examination ofchicken and meat products samples:

1- Preparation of the samples according to APHA(2001).

2- Determination of total mould count according to ISO 21527/1(2009).

3- Identification of mould isolates according to Koneman and Roberts (1985).

4- Screening of toxigenic Aspergilli according to Hara,et al.,1994.

5- Confirmation of mycotoxins production by cultivation and extractionof Aspergillus toxins according to Pestka (1996)and application of thin layer chromatography (TLC) according to Schuller and Egmond (1991).

The obtained data were statistically evaluated by Analysis of Variance (ANOVA) according to Feldman et al., (2003)

RESULTS

Table (1): Statistical analytical results of bacterial counts in the examined samples of ready to eat chicken and meat products (n = 25).

Criteria	Chicken products						Meat products					
	Shieshtawook			Pattie			Scallop			Salami		
	Min.	Max.	Mean ± SE	Min.	Max.	Mean ± SE	Min.	Max.	Mean ± SE	Min.	Max.	Mean ± SE
APC	9.7×10^{4}	1.1×10^{7}	2.29×10^{6} $\pm0.36\times10^{6}$	8.5×10^{3}	6.2×10^{6}	7.64×10^{5} $\pm2.10\times10^{5}$	1.9×1 0^{3}	4.7×1 0^{6}	2.08×10^{5} $\pm0.52\times10^{6}$	1.0×1 0^{4}	4.0×1 0^{6}	4.88×10^{5} $\pm 0.48\times10^{5}$
TEC	3.3×10^{2}	2.6×10^{5}	8.61×10^{3} $\pm1.95\times10^{3}$	1.2×10^{2}	4.9×10^{4}	2.76×10^{3} $\pm1.47\times10^{3}$	8.0×1 0	1.5×1 0^{4}	9.96×10^{2} $\pm2.37\times10^{2}$	1.5×1 0^{2}	3.0×1 0^{5}	4.18×10^{4} $\pm 1.48\times10^{4}$
TSC	4.0×10^{2}	7.0×10^{5}	5.42×10^{4} $\pm1.08\times10^{4}$	2.0×10^{2}	3.1×10^{5}	1.13×10^{4} $\pm0.24\times10^{4}$	1.0×1 0^{2}	6.0×1 0^{4}	3.34×10^{3} $\pm0.60\times10^{3}$	1.0×1 0^{2}	5.0×1 0^{4}	6.58×10^{3} $\pm2.15\times10^{3}$

Min. = Minimum, Max. = Maximum, APC = Aerobic Plate Count, TEC = Total Enterobacteriaceae Count,

TSC = Total Staphylococci count, S.E = Standard Error of mean.

Table (2): Incidence of E.coli isolated from the examined samples of ready to eat chicken and meat products.

Criteria	Chicken products				Meat products				Strain characteristic
	Shieshtawook		Pattie		Scallop		Salami		
	NO.	%	NO.	%	NO.	%	NO.	%	
O26:K60(B6)	1	4%	-	-	1	4%	-	-	EHEC
O119:k69(B19)	2	8%	-	-	1	4%	-	-	EPEC
O124:K72(B17)	2	8%	2	8%	-	-	-	-	EIEC
O128:K67(B12)	-	-	1	4%	-	-	-	-	ETEC
O111:K58(B9)	-	-	-	-	-	-	1	4%	EHEC
Untypable	1	4%	-	-	-	-	1	4%	-
Total	6	24%	3	12%	2	8%	2	8%	

EPEC: Enteropathogenic E. coli, EIEC: Enteroinvasive E.coli, ETEC: Enterotoxigenic E. coli, EHEC: Enterohaemorrhagic E.coli

Table (3): Incidence of Salmonella isolated from the examined samples of ready to eat chicken and meat products.

Criteria	Chicken products				Meat products			
	Shieshtawook		Pattie		Scallop		Salami	
	NO.	%	NO.	%	NO.	%	NO.	%
Salmonellaenteritidis	1	4%	-	-	-	-	-	-
Salmonella typhymurium	1	4%	1	4%	-	-	-	-
Total	2	8%	1	4%	-	-	-	-

Table (4): Incidence of Staphylococcus aureus isolated from examined samples of ready to eat chicken and meat products

Criteria	Chicken products				Meat products			
	Shieshtawook		Pattie		Scallop		Salami	
	NO.	%	NO.	%	NO.	%	NO.	%
Staphylococcus aureus	-	-	-	-	-	-	4	16%
Total	-	-	-	-	-	-	4	16%

Table (5): Totalmould counts/gm of the examined chicken and meat products samples: (N= 25 of each):

Samples	Positive samples		Minimum	Maximum	Mean ± S.E
	No.	%			
Shieshtawook	19	76%	5.0×102	3.0×105	2.43×104±1.32×104
Pattie	22	88%	2.0×102	3.0×104	4.06×103±1.43×103
Scallop	20	80%	3.0×102	2.1×105	1.63×104±0.88×104
Salami	21	84%	5.0×102	5.0×104	1.18×104±0.42×104

S.E = Standard Error of mean.

Table (6): Incidence of mould species isolated from examined chicken and meat products samples: (n = 25)

Criteria	Chicken products				Meat products			
	Shieshtawook		Pattie		Scallop		Salami	
	NO.	%	NO.	%	NO.	%	NO.	%
Aspergillus	5	20%	15	60%	10	40%	8	32%
Cladosporium	-	-	5	20%	-	-	5	20%
Fusarium	15	60%	3	12%	15	60%	-	-
Penicillium	15	60%	7	28%	-	-	-	-
Trichoderma	10	40%	-	-	-	-	5	20%
Sporotricum	5	20%	4	16%	10	40%	15	60%
Alternaria	5	20%	-	-	5	20%	10	40%
Thamnidium	-	-	-	-	5	20%	10	40%

Table (7): Incidence of toxigenic strains of Aspergillusflavus(A. flavus) isolated from examined chicken and meat products samples (n = 25):

Samples	Total isolated A.falvus		Toxins producer ofA.flavus	
	No	%	No	%
Shieshtawook	3	12%	2	8%
Pattie	5	20%	-	-
Scallop	5	20%	2	8%
Salami	5	20%	4	16%

Table (8): Levels of Aflatoxins B1 and B2(ppp/ml of media) extracted from toxigenic strains of A.flavus isolated from the examined chicken and meat products samples.

Samples	Aflatoxin B1			Aflatoxin B2		
	Minimun	Maximum	Mean±SE	Minimum	Maximum	Mean±SE
Shiesht awook	41.4	69.4	55.4±19.80	6.8	14.1	10.45±5.16
Scallop	17.6	30.2	23.9±8.91	2.3	6.6	4.45±3.04
Salami	19.9	25.4	18.13±3.10	1.6	6.4	3.4±1.21

ppp = Part Per Pillion, S.E = Standard Error of mean.

DISCUSSION

Meat and chicken products are the most common food vehicles of human infection with enteropathogens throughout the world (Abd-El-Aziz et al.,2001). Meat exposed to different types of treatments from the point of slaughtering until it is ready for consumption,these will be added to the bacterial load of this meat. thus it may be contaminated with several types of organisms through long chain of preparation,handling of raw meat, processing, distribution,storage and retailing.

The result in table (1) recorded that the APC/g of examined samples of chicken and meat products were ranged from 9.7×104 to 1.1×107 with an average of 2.29×106 ±0.36×106 for shieshtawook, 8.5×103 to6.2×106 with an average of 7.64 ×105 ±2.10 ×105 for pattie,1.9 ×103 to 4.7 ×106 with an average of 2.08 ×105 ±0.52 ×106 for scallop and 1.0 ×104 to 4.0×106 with an average of 4.88×105 ±0.48×105for salamy. Shieshtawook samples were higher in microbial load than other products and this may be due to the addingof spices and vegetables (as green piper and tomatoes)during thepreparation of shieshtawook.Nearly the same result was obtained by Purabi and Joshi (2010) in chicken meat products.

Total Enterobacteriacae count in examined samples were ranged from3.3×102 to 2.6×105 with an average of 8.61×103 ±1.95 ×103 inshieshtawook, 1.2×102 to 4.9×104 with an average of 2.76×103 ±1.47 ×103 in pattie, 8.0 ×10 to 1.5 ×104 with an average of 9.96×102 ±2.37×102 in scallop and 1.5×102 to 3.0 ×105 with an average of 4.18×104 ±1.48 ×104 in salamy, The most highest count were found in salami samples may be due to itsmore frequently handling in

meat products were obtained by Elwi,1994 and Enas(2011). Meanwhile, total staphylococcal count in examined samples were ranged from 4.0×102 to 7.0×105 with an average of 5.42×104±1.08×104 inshieshtawook, from 2.0 ×102 to 3.1 ×105 with an average of 1.13×104 ±0.24×104 for pattie , from 1.0×102 to 6.0 ×104 with an average of 3.34 ×103 ±0.60 ×103 in scallop and from 1.0 ×102 to 5.0 ×104 with an average of 6.58 ×103 ± 2.15 ×103 in salamy. Nearly similar results of salamy and lower results of scallop were obtained by Enas(2011)in meat products while she recorded lower results in case of chicken products.

Table (2) indicates the incidence of E.coli isolated from chicken and meat samples in which 24% of sheishtawook samples were contaminated with E.coli that identified as O26:K6 (B6) (4%) , O119: K69 (B19) (8%) , O124 :K72 (B17) (8%) and untypable(4%)serovars.E. coli could also isolated from12% of pattie samples and identified as8% serovarO124:K72(B17) and 4% serovar O128:K67(B12). Meanwhile E. coli could be isolated from 8% of scallop "4% each of O26:K60(B6) and O119:k69 (B19)", and from 8% of salamy samples "4% each of O111:K58(B9) and Untypableserovars".

Such enteropathogenic E.coli were previously isolated from chicken products by Abou-Hussein –Reham (2007), as well as from different ready to eat meat products by Soliman and El-Tabiy (2006), El-Rayes (2008) and Enas (2011). According to Bryan (1982), O128 serotype of E.coli is called enterotoxigenic E. coli (ETEC), while strains causingdesentry like syndrome (O124) were known as Enteroinvasive E. coli (EIEC) and the strains causing haemorrhagic colitis (O111) were recognized as Enteroheamorrhagic E.coli (EHEC).

Table (3) revealed that the incidence of Salmonella species isolated from chicken products samples were 8% fromshieshtawook (4% each of S.entritidisand S. typhimurium) and 4% frompattie samples identified as S.typhimurium but we couldn't isolateany Salmonellae from meat product samples (scallop and salamy).Salmonellaespp. were previously isolated from ready to eat meat products by Soliman et al., 2002; Richardson and Stevens (2003) and Enas (2011) whileEhab(2003) and Reham(2007) couldn't isolate salmonella from chicken and meat products. Practically, all food of animal origin may be a vehicle for transmission of salmonella to man. Meat and chicken products may be contaminated withhuman excreta at any step of processing chain; during handling of raw material orpreparation of such food in kitchen (Fathi et al.,1994). Ourobtained results showed that E.coli is more prevalent in examined samples than salmonella spp. This is agree

with Zaho et al., (2001)and Purabi and Joshi (2010) whose reported high prevalence of E. coli than salmonella spp. in poultry productsas well as in retail meat market had reported by Kumar et al., (2001).

Table(4) showed the incidence of Staph.aureusin the examined chicken and meat products samplessamples. Results revealed that 16% of salamy samples contaminated with Staph. aureus while all other samples were free from Staph. aureus. The presence of Staph.aureus in salami samples only may be due to the excessive handling in supermarket during retail.

The negative samples results were similar to those obtained by Tolba(1994) and Mohamed (2000);they couldn't detect or isolate Staph .aureusin any of finished heat treated meat products they were examined. On the other hand, Nesreen(2003), Reham(2007) and Enas (2011) could isolate Staph.aureusfrom meat and chicken products.

Staph.aureus enters the food through the ex-charges of nasal passage and the infected wounds of many persons that may act as a common source of infection (Frazier and Wethoff, 1983).

Table (5) revealed the results of total mould count /gm of examined chicken and meat samples.It ranged From 5×102 to 3.0×105 with an average of 2.43×104 ±1.32 ×104 inshieshtawook, from 2.0×102 to 3.0×104 with an average of 4.06×103±1.43×103 in pattie, from3.0 ×102 to 2.1×105 with an average of 1.63×104±0.88×104 in scallop and from 5.0×102to 5.0 ×104 with an average of 1.18×104±0.42×104 in salami samples. Nearly similar results in chicken products recorded by Purabi and Joshi (2010). Meanwhile, nearly similar results in meat products were recorded by Hegazi et al., (1992),Maha and Sohad (2005) and El-shazly (2006),while,higher results were recorded by Shaltout (1996),Shahenda (2002) and Hanan and Marionette (2008).

Fungal growth can produce toxic metabolites which lead to mutagenic,carcinogenic and teratogenic effectsto the human health (EL-Shinawy et al.,1994) .Also mould contamination of food may cause acute and chronic intoxication to man resulting in serious clinical symptoms such as jaundice and vomiting (Sayed et al.,2002).

Table (6)showed the incidence of mould species isolated from the examined samples of chicken and meat products,which were comprises; Aspergillus, Cladosporium, Fusarium, Penicillium, Trichoderma, Sporotricum, Alternaria and

Thamnidium. The highest percentage of Aspergillus species (60%) was isolated from pattie samples, while, the highest percentage of Penicillium was fond inshieshtawook samples. This high percentage of Aspergillus may be high enough to produce toxins and constitute a dangerous hazards to consumers. Similar to our results, Altalhi and Alboshan (2004) had also reported contamination of chicken products with Penicillium sp. and Aspergillus sp.

The incidence of toxigenic strains of Aspergillusflavus isolated from examined samples of chicken and meat products was shown in table (7). The toxin producing A.flavus was found in highest percentage in examined salami samples (16%) followed by shieshtawook and scallop samples (8% in each). In contrast, in pattie samples, we could not detect toxigenic strains of Aspergillusflavus in such product. Nearly the same results of Aspergillus spp. incidence were recorded by Hassan(2004); Ouf(2004) and hanan and Marionette (2008), in meat product samples they were examined.

Regarding the results in Table (8),the average amount of Aflatoxins B1 and B2 produced by A.flavus(on cultivated media) isolated from shieshtawook was the highest contents among our results followed by salami and scallopisolates. These results indicate that; the risk of production of aflatoxins B1 and B2 in these products is present if subjected to suitable growth conditions for the toxigenic strains they were harbored.The current results agreed with those recorded by many investigators;Hassan (2004); Hanan and Marionette (2008) as they could isolateAflatoxigenic strains of A. flavus from meat products.

We can concluded that; the organisms like Salmonellae, E.coli, Aspergillus spp.,Penicillium spp. and Fusarium spp. were the most prevalent contaminants in the examined samples from various markets of our study.Also, our study confirm the prevalence of toxigenic strains of Aspergillusflavus in most examined products except pattie samples. These contaminants can possess health hazards to consumers in consumption of such meat products

We can recommend that; contamination should be controlled through strict precautions, to minimize the risk of hazards, such as accurate control of the relative humidity and temperature for the storage of chicken and meat products.Also, addition of preservatives and/or food additives should be under control and examined periodically for bacterial, fungal contamination and mycotoxins production as well as suitable storage conditions to avoid microbial or/and mycological growth.

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التقييم الميكروبى لبعض منتجات الدواجنواللحوم

حنان محمود لماضة[1]، ماريونت زغلول نصيف[2] ، نسرين زكريا عليوة[1]

١ – قسم صحة الأغذية معهد بحوث صحة الحيوان – فرع طنطا
٢ – قسم صحة الأغذية معهد بحوث صحة الحيوان – فرع بنها

وأجريت هذه الدراسة على عدد مائة (١٠٠) عينة من منتجات الدواجن (الشيش طاووك والباتيه) ومنتجات اللحوم (الاسكالوب والسلامى) ٢٥ عينة من كل منتج والتي تم تجميعها بصورة عشوائية من المحلات السوبر ماركت بمحافظتي القليوبية والغربية لفحصها بكتيريا وميكولوجيا. أوضحت نتائج الدراسة على ان متوسط العدد الكلى للميكروبات الهوائية،العدد الكلى للميكروبات المعوية والعدد الكلى للمكور العنقوديكالتالي: ١٠٦×٢.٦٩ ±١٠٦×٠.٣٦، ١٠٣×٨.٦١±١٠٣×١.٩٥، ١٠٤× ٥.٤٢ ±١٠٤×١.٠٨ لعينات الشيش طاووك، ١٠٥×٧.٦٤±١٠٥×٢.١، ١٠٣× ٢.٧٦ ±١٠٣×١.٤٧، ١٠٤× ١.١٣ ±١٠٤×٠.٢٤ لعينات الباتيه ، ١٠٥×٤.٨٨±١٠٥×٠.٤٨، ١٠٤×٤.١٨±١٠٤×١.٤٨، ١٠٣× ٦.٥٨ ±١٠٣×٢.١٥ لعينات السلامي. كما تم عزل ميكروب الايشريشيا كولاى بنسبة ٢٤%،١٢%،٨%و٨% لعينات الشيش طاووك ، الباتيه،الاسكالوب والسلامى على التوالي . كذلك تم عزل ميكروب السالمونيلا بنسبة ٨% و٤% لعينات الشيش طاووك والباتيه على التوالي ، كما تم عزل ميكروب المكور العنقودي الذهبي بنسبة ١٦% من عينات السلامى فقط .وكذلك تم الفحص الميكولوجى للعينات وقد وجد ان المتوسط العدد الكلى للفطريات هو ١٠٤×٢.٤٣±١٠٤×١.٣٢،١٠٤×٤.٠٦×١٠٣±١٠٣×١.٤٣،١٠٣×١.٦٣±١٠٤×٠.٨٨و١٠٤×١.٨٨±١٠٤×٠.٤٢× ١٠٤ لكل من الشيش طاووك ،الباتيه،الاسكالوب والسلامى على التوالى. وقد تم عزل وتصنيف فطر الاسبرجيلس وتحديد عترات الاسبرجيلس فلافس التى لها قدرة على إفراز الافلاتوكسين وكذلك تم استخلاص سموم الافلاتوكسين B1، B2 بكميات مختلفة من هذه العترات المعزولة من عينات الشيش طاووك ، الاسكالوبوالسلامى. وقد تمت المناقشة الصحية للميكروبات المعزولة من البكتريا والفطريات وكذلك تم مناقشة بعض التوصيات اللازم تطبيقها للحد من تلوث منتجات الدواجن واللحوم والتي تؤدى إلى تحسين جودتهاوسلامتها.