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Mycological assessment of quail meat in Menufiya governorate, Egypt

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ABSTRACT

This study was conducted to assess the mycological contamination of quail carcasses in Monofiya governorate. Total of 100 samples of fresh and frozen quail meat were taken from breast and thigh (50 of each) with skin and without skin (25 of each) from different retail shops for mycological examination and mycotoxin residues. The obtained results revealed that the highly contaminated samples in Mold and Yeast counts were in frozen quail meat of thigh with and without skin ones ($1.21 \times 10^6 \pm 4.59 \times 10^5$, $1.77 \times 10^6 \pm 6.72 \times 10^5$) and ($1.76 \times 10^6 \pm 5.65 \times 10^5$, $9.79 \times 10^5 \pm 4.54 \times 10^5$) (cfu/g), respectively. Furthermore, the highest incidence of mold serotypes was *Aspergillus spp.* Specially *A. flavus* in all samples. On the other hand, mycotoxins residue was higher in frozen samples than fresh ones. Breast without skin samples were the highest in mycotoxin residues than others (7.3 ± 0.04 , 3.8 ± 0.04 , 1.9 ± 0.02) (ug/l) for B1, B2 and G1 in both fresh and frozen samples, respectively. The public health importance of these contamination and the suggestive hygienic measures to improve the quality and safety of quail meat were discussed.

1. INTRODUCTION

Quail is one of the leanest types of poultry and good source of protein with very high amino acid and minerals contents, important polyunsaturated fatty acids (PUFA:S) of meat include the essential fatty acids; linoleic acids (C18:2n -6) and α -linoleic acid (C18:3n); as well as C 20 and C 22 PUFA:S that are present in the phospholipids (Enser et al., 1996).

Quail meat is considered superior to red meat as it contains low fat content, low cholesterol, high amount of iron and considerable amounts of sodium and potassium (Jaturasitha et al., 2004).

Freezing represents, a preservation method of poultry meat at temperature below -10°C , is a process which improves meat quality by two related process; temperature decrease and change of water state from liquid to solid. Both processes tend to reduce the level of physical and chemical modification, being able to increase shelf lifetime of meat (Barbut, 2002)

The fungal growth occurs mainly during refrigerated storage. These growths led to undesirable and imparted musty off-odor and economic losses. Moreover, mycotoxins might possess potential hazards to food safety and human health with mutagenic, carcinogenic and teratogenic effect (El-Shinawy et al., 1994)

Some mold species can cause respiratory infections representing a significant risk for individual with severely weakened immune system (OSHA, 2010).

The most important mycotoxins are produced by molds belong to genera *Aspergillus*, *Penicillium* and *Fusarium* (Pitt, 2002). Yeast are ubiquitous in nature and may be found as a part of the normal flora of the meat due to contamination and neglected hygienic measures adopted during preparation

and handling of the meat. On the other hand, yeasts have the ability to colonize on the meat cutting surfaces and utensils as well as refrigerators and grinding machines, especially when ecological parameters (water activity, temperature and nutrition) are available (Farghaly et al., 2000).

Exposure to aflatoxins in the diet is considered as important risk factor for the development of primary hepatocellular carcinoma, particularly in individuals already exposed to hepatitis B. In classical epidemiology several studies have linked liver cancer incidence to estimated- aflatoxin consumption in the diet (Lie et al., 2001).

Therefore, this present study was conducted to assess the mycological contamination in quail meat.

2. MATERIAL AND METHODS

2.1. Collection of samples:

A total of 100 random meat samples were taken from breast and thigh of fresh and frozen quail carcasses (50 of each), with skin and without skin (25 of each) and collected from different abattoirs in Menufiya governorate, Egypt. All collected samples were transferred in an ice box and transferred to laboratory under complete aseptic condition without undue delay for the following examination. The frozen carcasses were left to thaw under complete aseptic condition.

2.2. Preparation of sample (APHA, 2001):

Twenty-five gm of the examined quail meat samples were transferred to aseptic blender jar and 225 ml of 0.1 % sterile buffered peptone water were aseptically added to the content of jar. Each sample was then homogenized in the homogenizer at 2000 rpm for 1-2 min to provide a homogenate, from which tenth fold serial dilutions were

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prepared. The prepared samples were subjected to the following examination:

2.2.1. *Mold and yeast count* were conducted following Baily and Scott, (1998)

2.2.2. *Isolation and identification of mold* (Abraham et al., 1993)

2.2.2.1. *Macroscopic examination*

2.2.2.2. *Microscopic examination*

2.2.3. *Isolation and identification of yeast.*

2.2.4. *Qualitative and quantitative estimation of aflatoxins:* (B1, B2, G1 and G2) by ELISA

3. RESULTS

It was evident from the results in table (1) that the mold and yeast count (cfu/g) in fresh quail meat were $1.33 \times 10^4 \pm 4.76 \times 10^3$ and $1.19 \times 10^4 \pm 3.43 \times 10^3$ and $1.77 \times 10^4 \pm 4.88 \times 10^3$ and $1.68 \times 10^4 \pm 4.54 \times 10^3$ in breast and thigh with and without skin, respectively. Yeast count (cfu/g) was $8.65 \times 10^3 \pm 2.86 \times 10^3$ and $1.14 \times 10^4 \pm 4.03 \times 10^3$ and $1.44 \times 10^4 \pm 4.02 \times 10^3$ and $1.66 \times 10^4 \pm 5.42 \times 10^3$ in breast and thigh with and without skin, respectively. Moreover, incidence of mold and yeast serotypes in fresh quail carcasses as in table (2) were in breast and thigh with and without skin were, *Aspergillus spp* ((21) 84% and (25) 100% and (17) 68% and (18) 72%), *Mucor*

spp ((8) 32% and (9) 36% and (7) 28% and (5) 20%) and *Penicillium spp* ((6) 24% and (7) 28% and (5) 20% and (4) 16%) and *Rhizopus* (0% and (2) 8% and 0% and (1) 4%). On the other hand yeast species were candida (1 (44%), 9 (36%), 13 (52%) and 16 (64%)), *Rhodotorula* (2 (8%), 3 (12%), 1(4%) and 1(4%)) and *trichosporum* (3 (12 % , 3 (12%), 4 (16%) and 0%) in breast and thigh with and without skin, Respectively.

Mold and yeast counts (cfu/g) in frozen quail meat in table (1) were $1.09 \times 10^6 \pm 3.91 \times 10^5$ and $1.19 \times 10^6 \pm 4.12 \times 10^5$ and $1.21 \times 10^6 \pm 4.59 \times 10^5$ and $1.76 \times 10^6 \pm 5.65 \times 10^5$ in breast and thigh with and without skin, respectively.

Yeast count (cfu /g) was $5.71 \times 10^5 \pm 2.70 \times 10^6$ and $8.14 \times 10^5 \pm 3.91 \times 10^5$ and $1.77 \times 10^6 \pm 6.72 \times 10^5$ and $9.79 \times 10^5 \pm 4.54 \times 10^5$ in breast and thigh with and without skin, respectively. Wherever, the incidence of mold species in frozen quail meat were *Aspergillus* ((12) 48%, (16) 64%, (10) 40% and (13) 52%), *Mucor spp* were ((6) 24%, (3) 12%, (5) 20% and (9) 36%), *Penicillium spp* were ((6) 24%, (8) 32%, (5) 20% and (6) 24%) in breast and thigh with and without skin, respectively, *Rhizopus spp* were ((1); 4%) not found in breast without skin and in thigh and *Alternaria* found only in thigh with skin (2) 8%, respectively. And yeast species were candida (13 (52 %), 1 (4%), 15 (60%) and 13 (52%)), *Rhodotorula* (2 (8%), 2 (8%), 2 (8%) and 4 (16%)), *trichosporum* 3 (12%), 1 (4%), 1 (4%) and 0%) in breast and thigh with and without skin, respectively .

Table 1 Mean values of mold and yeast (cfu/g) count in fresh and frozen quail carcasses (n=25)

Samples	Fresh						Frozen					
	Mold		Yeast		Mold		Yeast		Mold		Yeast	
	No	%	Mean ± S.E	No	%	Mean ± S.E	No	%	Mean ± S.E	No	%	Mean ± S.E
Breast with skin	18	72	$1.33 \times 10^4 \pm 4.76 \times 10^3$	16	64	$8.65 \times 10^3 \pm 2.86 \times 10^3$	19	76	$1.09 \times 10^6 \pm 3.91 \times 10^5$	18	72	$5.71 \times 10^5 \pm 2.70 \times 10^5$
Breast without skin	17	68	$1.19 \times 10^4 \pm 3.43 \times 10^3$	15	60	$1.14 \times 10^4 \pm 4.03 \times 10^3$	18	72	$1.19 \times 10^6 \pm 4.12 \times 10^5$	16	64	$8.14 \times 10^5 \pm 3.91 \times 10^5$
Thigh with skin	20	80	$1.77 \times 10^4 \pm 4.88 \times 10^3$	18	72	$1.44 \times 10^4 \pm 4.02 \times 10^3$	20	80	$1.21 \times 10^6 \pm 4.59 \times 10^5$	18	72	$1.77 \times 10^6 \pm 6.72 \times 10^5$
Thigh without skin	19	76	$1.68 \times 10^4 \pm 4.54 \times 10^3$	17	68	$1.66 \times 10^4 \pm 5.42 \times 10^3$	19	76	$1.76 \times 10^6 \pm 5.65 \times 10^5$	18	72	$9.79 \times 10^5 \pm 4.54 \times 10^5$

There is no significant difference between samples (P>0.05)

Table 2 Serotyping of mold and yeast species in fresh and frozen quail carcasses (n=25)

	Fresh								Frozen							
	Breast skin		with		Breast skin		without		Thigh skin		with		Thigh skin		without	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%
<i>Aspergillus</i>	21	84	25	100	17	68	18	72	12	48	16	64	10	40	13	52
<i>A. fumigatus</i>	6	24	8	32	5	20	7	28	5	20	5	20	4	16	4	16
<i>A. flavus</i>	8	32	9	36	6	24	7	28	4	16	6	24	3	12	5	20
<i>A. niger</i>	7	28	8	32	6	24	4	16	3	12	5	20	3	12	4	16
<i>Mucor</i>	8	32	9	36	7	28	5	20	6	24	3	12	5	20	9	36
<i>Penicillium</i>	6	24	7	28	5	20	4	16	6	24	8	32	5	20	6	24
<i>Rhizopus</i>	-	-	2	8	-	-	1	4	1	4	-	-	-	-	-	-
<i>Alternaria</i>	-	-	-	-	-	-	-	-	-	-	-	-	2	8	-	-
<i>Candida</i>	11	44	9	36	13	52	16	64	13	52	11	44	15	60	13	52
<i>Rhodotorula</i>	2	8	3	12	1	4	1	4	2	8	2	8	2	8	4	16
<i>Trichosporum</i>	3	12	3	12	4	16	-	-	3	12	1	4	1	4	-	-

Percentages were calculated according to total No. of samples.

As shown in table (3) results of fresh samples recorded that Aflatoxins B1 residues were 4.5 ± 0.02 , 6.2 ± 0.05 ppm in breast with and without skin samples, but in thigh with skin AB1 not detected and 2.8 ± 0.02 in thigh without skin. While Aflatoxin B2 was 2.1 ± 0.01 ppm in breast with skin and not detected in breast without skin and in thigh. Moreover, Aflatoxins G1 was not detected in breast with skin and in thigh but in breast without skin was 1.6 ± 0.01 ppm. Also, Aflatoxin G2 was not detected in all samples. While results

of aflatoxins residues in frozen samples was B₁ 4.8 ± 0.03 and 7.3 ± 0.04 ppm in breast with and without skin and not detected in thigh with skin and 3.1 ± 0.04 ppm in thigh without skin. While Aflatoxin B2 was 1.1 ± 0.01 and 3.8 ± 0.04 ppm in breast with and without skin, respectively. But, not detected in thigh. Moreover, Aflatoxins G1 was not detected in all samples except in breast without skin was 1.9 ± 0.02 ppm and Aflatoxin G2 was not detected in all samples.

Table 3 Mean values of aflatoxins (ug/l) isolated from examined surface of fresh and frozen quail carcasses

Aflatoxin	Fresh				Frozen			
	Breast with skin	Breast without skin	Thigh with skin	Thigh without skin	Breast with skin	Breast without skin	Thigh with skin	Thigh without skin
B1	4.5±0.02	6.2±0.05	-	2.8±0.02	4.8±0.03	7.3±0.04	-	3.1±0.04
B2	1.1±0.01	3.6±0.03	-	-	1.1±0.01	3.8±0.04	-	-
G1	-	1.6±0.01	-	-	-	1.9±0.02	-	-
G2	-	-	-	-	-	-	-	-

There is no significant difference between samples (P>0.05)

4. DISCUSSION

Mold contamination of poultry meat may occur at any point along the production chain; in feed raw materials, compound poultry feed, poultry flocks or processing plants (Nurse, 1997). The importance of mold species occurred in meat was attributed to their biochemical ability to excrete fermentable enzymes which attack protein and fat (Abdel-Rahman and Saad, 1989).

The result recorded in table (1) revealed that the mold and yeast count were higher in thigh without skin, such result may be attributed to the unsanitary measures and difference in hygienic conditions under which the quail carcasses were prepared. While *Aspergillus* species in fresh quail was higher in breast without skin also *Aspergillus* was the most species isolated. Also, *Mucor*, *Penicillium* and *Rhizopus* were more in breast without skin, this result may be attributed to more contamination during scalding and removing of skin by workers. While, *Candida* was the most species of yeast isolated from fresh quail carcasses.

Moreover the result recorded revealed that the mold and yeast count in frozen quail carcasses were higher in thigh with skin, such result may be attributed to contamination during evisceration, prolonged frozen storage period, bad handling during retail display and bad storage conditions, halving quartering and also the water used for cleaning and personal uses (Thatcher and Clark, 1978).

Aspergillus species was more species of mold isolated from frozen quail carcasses, also *Candida* species was more species of yeast isolated from frozen quail carcasses and was more in thigh with skin than breast and thigh without skin.

From the previous records there is no significant difference between the examined samples counts (P>0.05).

According to mold and yeast count in fresh quail carcasses count was nearly similar to those obtained by Mohsen (2005) that found mold count was $1.2 \times 10^2 \pm 1.0 \times 10^2$ cfu/g in quail meat, Abd Elrahman et al. (2013) that found yeast count was $4.6 \times 10^3 \pm 1.1 \times 10^3$ cfu/g in chicken carcass and Suzan Abd Almotalb (2012) found that mold and yeast count ($9.37 \times 10^3 \pm 2.65 \times 10^3$), ($2.33 \times 10^4 \pm 0.24 \times 10^4$) in chicken surfaces stored. And higher result obtained by Yassein et al (1991) 2.6×10^4 in sparrows, Bkheet et al (2007) 1.3×10^4 in chicken burger, and Mohamed et al (2016) $7 \times 10^4 \pm 1.7 \times 10^4$ and $2.2 \times 10^5 \pm 2.7 \times 10^4$ cfu/g yeast and mold. While lower result was obtained by El Atabany (1986) 5.9×10 in poultry minced meat.

Mold and yeast count in frozen quail carcasses count was nearly similar to those obtained by Mostafa (2001) 5.7×10^4 cfu/g in frozen quail, El-Kewaley et al. (2014) $2.0 \times 10^4 \pm 4.6 \times 10^2$ for mold count while yeast count was $3.2 \times 10^4 \pm 7.0 \times 10^4$ in frozen poultry meat and Noha (2018) $1.75 \times 10^4 \pm 4.89 \times 10^3$ and $9.78 \times 10^3 \pm 4.06 \times 10^3$ for mold and yeast count, respectively, in frozen quail meat. While lower results obtained by Gergis (2004) found mold and yeast count were $1.7 \times 10^2 \pm 7.3 \times 10$ and $3.2 \times 10^3 \pm 9.1 \times 10^2$ cfu/g

According to result in table (3), higher values of mycotoxin were recorded in frozen quail carcasses than fresh quail carcasses. And higher results were recorded in breast without skin than other samples for Aflatoxin (B1, B2, G1 and G2). While no aflatoxin detected in thigh with skin. Chronic exposure to aflatoxin above the FDA guideline (20 ppb) affects many organs, however, the major targets is the liver. Aflatoxins are hepatotoxic in humans and animals (FDA, 2013).

Quail carcasses examined in this study were subjected to various degree of contamination through quail processing and handling especially *Aspergillus* species and Aflatoxin B1 in meat of breast without skin samples.

Therefore, a concerted effort should be made to maintain sanitary condition in processing, preparation and handling, packaging, transportation and storage of quail carcass, periodical sanitation of utensils, chilling rooms and freezing cold stores and periodical examination of workers and hand washing facilities should be present

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