Evaluation of the Quality of the Minced Meat in Egyptian Markets

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A B S T R A C T

The aim of the present study is to evaluate the quality of minced meat (fresh – frozen) in Egyptian markets. A total of 90 minced meat samples (45 fresh – 45 frozen) were collected from butchers and retailed supermarkets shops in different locations in Egypt.All collected samples were transferred directly to the laboratory in an ice box under complete aseptic conditions without any delay and then subjected to bacteriological examination to evaluate the quality of minced meat based on their contamination with coliform and staphylococcus spp. The obtained results indicated that the mean value of staphylococcal count and coliform count of the examined fresh minced meat samples were 26.0 ± 2.2× 10^2 cfu/g and 19.0 ± 0.8 × 10^3 cfu/g, respectively, while of the frozen minced meat samples were 8.8 ± 0.7×10^2 cfu/g, and 14.8 ± 0.5 ×10^3 cfu/g respectively. 100 % of the examined fresh minced meat samples (45 samples) were unaccepted samples and 33.3% of the examined samples identified as *Staph. Aureus* and 28.9 % of the examined frozen minced meat samples (13 samples) were unaccepted samples and 23.1% identified as *Staph. Aureus* according to EOS 1694 / 2005 (10^2 cfu/g). Accepted samples based on their coliforms count were 68.8 % and 88.8 % for fresh and frozen samples , respectively according to EOS (1694/ 2005). These results indicated that the microbiological quality of retailed minced meat samples were unsatisfactory, and have health hazards for consumers as it may be lead to food poisoning.

Key words: Fresh Meat, Frozen meat, coliform, Staphylococcal.

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1. INTRODUCTION

People depending on the meat as daily food worldwide because of its high protein content. Protein of the meat consists of essential amino acids that have been considered as good source for the human body needed (Olaoye, 2011).

Moreover, meat contain high level of water corresponding to the water activity of approximately 0.99, which is suitable for the growth of different types of microorganisms (Rao et al.,2009).

In the last few years, there were a huge increase in the consumption of processed meat worldwide because of their convenience to consumer and their nutritive values (Rajic´et al., 2007).

On the other hand, meat products are a major source of diseases especially foodborne

diseases and related to worldwide out breaks resulting from food poisoning .For that reason, food poisoning bacteria especially Salmonella organisms which cause meat products contamination (Amin-Reham, 2004 and Erdem et al., 2005).

Hence, meat become unfit for human consumption when subjected to spoilage and its enzymatic changes, microbial action and any other factors (Bradeeba and Sivakumaar, 2013).

Likewise, ground meat enter mainly in most types of meat products meals as a source of food animal origin , so it has high economic value because of its nutritive quality but also, ground meat highly subjected to food poisoning resulting from microbial contamination (Velzen et al., 2008).

Also, ground meat is not only highly susceptible to spoilage, but also is frequently involved in the spread of pathogens (Ahmed and Ismail, 2010).

Besides, studies on the microbiological quality of food , ground meat considered a good medium for the growth of the pathogenic microorganisms as the minced meat rich in nutrients required for this growth (Elmali and Yaman 2005 and Norman et al., 2006). In addition, high incidence of illness and death worldwide resulting from spoilage of the meat (Adak et al., 2005). It is due to consumption of bacteria, toxins and cells produced by pathogenic microorganisms present in food (Clarince et al. 2009).

On the other context, minced meat may be polluted with biological agents during production, processing, storage and marketing that may be serious to human health (Siriken, 2004), accordingly high levels of micro-organisms including pathogens means low meat quality depending on the hygienic measures of meat processing (Tachbele et al., 2006). Determination of enterobacteriaceae considered as the main element in quality judgement of slaughter hygiene and slaughter - houses (Zweifel et al, 2008). Moreover, The *Staph. Aureus* is ubiquitous in nature and inhabits the mucous membranes and skin of most warm-blooded animal including food animals and humans. Up to 50% of humans may carry this organism in their nose and throats and on hair and skin (USFDA, 2004). Furthermore, Salmonella is the second popular cause of illness. millions cases of food borne diseases recorded every year (HGlC, 2000). In conclusion, the recorded data from several European countries show that the incidence of salmonella in minced meat beef ranged from 0.0% to 3.6%, with a mean of 1.1% (Anon, 2006). Also, in Egypt the incidence of salmonella reached 20% of frozen meat beef samples (Hassanin et al. 2011).

In addition, the *E. coli* is the most common cause to infants, children diarrhea cases, many species as (buffalo, cows and sheep) were the highest reservoir of *E. coli* infection to man (Taha, 2002). Recognizing this, the World Health Organization developed its Global Strategy for Food Safety. So, The microbiological safety of food is occurred by absence of pathogenic microorganisms and by applying measures for preventing their multiplication (Omemu and Bankole 2005).

Furthermore, the food safety measures should be done perfectly in application of HACCP (Hazard analysis critical control point), for reducing the food-borne illnesses and to maintain the level of microbial load of raw meat in check, but in developing countries, the bad sanitary level during transportation and storage conditions not only the cause of contamination but also enhance the growth of pathogenic bacteria in meat in addition to different types of spoilage (Javed, 2016).

2. MATERIALS AND METHODS

2.1. Collection of samples:

A grand total of 90 random minced meat samples classified into fresh and frozen (45 0f each) were collected from local supermarkets and retail shops from different locations all over the country. The collected samples were transferred directly to the laboratory in an ice box under complete aseptic conditions without any delay and then subjected to following examination to evaluate chemical and bacteriological quality after thawing in the refrigerator overnight.

2.2. Preparation of samples (ISO, 2003):

2.3. Determination of Total coliforms count (ISO, 2004):

2.4. Determination of Total staphylococcal count and Isolation of *staphylococcus aureus* (FDA, 2001)

2.5. Identification of suspected *Staph. aureus*

Morphological identification: (Cruickshank et al , 1975)

Gram staining:

Motility test:

Biochemical identification: (FDA , 2001)

Detection of haemolysis:

Indole test:

Methyl red test:

Catalase test:

Oxidase test:

Sugar fermentation test:

Coagulase test (Tube coagulase test):

3. RESULTS

3.1. Total Staphylococcal counts (cfu/g) of the examined fresh and frozen minced meat samples:

in the present study, it is evident from the results recorded in Table (1) that total staphylococcal count of the examined fresh minced was ranged from 11 × 10^3 to 41 × 10^3cfu/g, with a mean value of 26.0 ± 2.2× 10^3cfu/g while of the frozen minced meat samples was ranged from 4.6 × 10^3 to 13 × 10^3 cfu/g with a mean value of 8.8 ± 0.7×10^3cfu/g .

table (2) show that 100 % of the examined fresh minced meat samples (45 samples) were unaccepted samples and 28.9 % of the examined frozen minced meat samples (13 samples) were unaccepted samples but 71.1% were accepted (32 samples) based on their staphylococcal count. There is a Significant difference between the examined frozen and fresh minced meat samples (P >0.05).

3.2. The incidence of *Staph. aureus* (cfu/g) of the examined fresh and frozen minced meat samples:

The results recorded in Table (3) revealed that unaccepted samples for *Staph. aureus* of the examined fresh and frozen minced meat samples (45 for each) were 15 and 3 samples , respectively.

Table (3) decleared the acceptability of the examined samples of fresh and frozen minced meat samples based on the incidence of *Staph. Aureus* shown that 33.3 % of the examined fresh minced meat samples (15 samples) were unaccepted samples (exceeded the permissible limits (10^2/g) according to EOS (2005)) but 66.6 % of were accepted (30 samples) and 6.6 % of the examined frozen minced meat samples (3 samples) were unaccepted samples (exceeded the permissible limits (10^2/g) according to EOS (2005)) but 93.3 % were accepted (42 samples).

3.3. Total Coliforms count (cfu/g) of the examined fresh and frozen minced meat samples:

Results achieved in table (4) revealed that coliforms count of the examined fresh minced was ranged from 16 × 10^3 to 22 × 10^3 cfu/g, with a mean value of 19.0 ± 0.8 × 10^3cfu/g while of the frozen minced meat samples were ranged from 9.5 × 10^3 to 20 ×

10^3 cfu/g with a mean value of 14.8 ± 0.5 $\times 10^3$cfu/g.

Table (5) and fig (5) decleared the acceptability of the examined samples of fresh and frozen minced meat samples based on their coliforms count shown that 31.1% of the examined fresh minced meat samples (14 samples) were unaccepted samples but 68.8% were accepted (31 samples) and 11.1 % of the examined frozen minced meat samples (5 samples) were unaccepted samples but 88.8 % were accepted (40 samples).

Table (1) statistical analytical results of staphylococcal count (cfu/g) in the examined fresh and frozen minced meat samples (n = 45 for each × 10^3).

Mince Meat samples	Min.	Max.	Mean ± S.E*
Fresh	11	41	26.0 ± 2.2
Frozen	4.6	13	8.8 ± 0.7

*SEM = Standard error of mean.
N.B: Significant difference (P<0.05).

Table (2) acceptability of the examined fresh and frozen minced meat samples based on their Staphylococcal count (n = 45).

Minced meat samples	+ve samples		MPL[2]	accepted samples		Unaccepted samples	
	No	%		No	%	No	%
fresh	15	100%	10^2	-	-	45	100%
frozen	13	28.9%	10^2	32	71.1%	13	28.9%

[2] MPL = Maximum permissible limit according to EOS (1694/ 2005).

Table (3) acceptability of the examined fresh and frozen minced meat samples based on their Staph. Aureus count (n = 45).

Minced meat samples	+ve samples		MPL[2]	accepted samples		Unaccepted samples	
	No	%		No	%	No	%
fresh	15	33.3%	free	30	66.7%	15	33.3%
frozen	3	23.1%	free	10	76.9%	3	23.1%

[2] MPL = Maximum permissible limit according to EOS (1694/ 2005)

Table (4) statistical analytical results of coliforms count (cfu/g) in the examined fresh and frozen minced meat samples (n = 45 for each × 103).

Mince Meat samples	Min.	Max.	Mean ± S.E*
Fresh	16	22	19.0 ± 0.8
frozen	9.5	20	14.8 ± 0.5

*S. E = Standard error of mean.

N.B: Significant difference (*(P<0.05).*

Table (5) acceptability of the examined fresh and frozen minced meat samples based on their coliforms count (n = 45).

Minced meat samples	+ve samples		MPL[2]	accepted samples		Unaccepted samples	
	No	%		No	%	No	%
fresh	14	31.1%	10^2	31	68.9%	14	31.1%
frozen	5	11.1%	10^2	40	88.9%	5	11.1%

[2] MPL = Maximum permissible limit according to EOS (1694/ 2005).

4. DISCUSSION

Total Staphylococcal counts (cfu/g) of the examined fresh and frozen minced meat samples:

these high results due to bad handling of the meat, Staph SPP. Present on human hands, nasal passages or throats. accumulation of bacteria on meat handlers lead to production of heat stable toxins in the meat as recorded in table (1) .

These results obtained in table (1) are nearly similar to results obtained by Datta et al., (2012). However higher findings were obtained by Al kour (2001) who found that the mean value of staphylococcal count were $4.13 \times 10^3 \pm 1.25 \times 10^3$cfu/g, El Taher - Amna (2009) who reported that the mean value of staphylococcal count were 4.16×10^3cfu/g, Goja et al., (2013) who found that the staphylococcal count ranged from 3.23×10^3 to 8.7×10^3cfu/g.

While lower results obtained by Bouzid et al., (2015) who found that the incidence of Staphylococcus in examined samples were 4.45%, Guemour et al., (2015) who found that the incidence of Staphylococcus in examined samples were 4.45%. Shaltoot et al., (2016) who recorded that the incidence of presence of staphylococcal count was low.

Staphylococcal food poisoning is a food borne intoxications that develops in people who ingest food that has been improperly prepared or stored. The severity of illness depends on the amount of food ingested, the amount of toxin in ingested food and the general health of the victim (Schelin et al., 2011).

Patients become symptomatic within 2-4hrs. after ingestion of thermostable staphylococcal enterotoxins of an approximate dose of 0.1 to 1.0 mg/kg of body weight (Stewart et al., 2005).

The incidence of *Staph. aureus* (cfu/g) of the examined fresh and frozen minced meat samples:

Staph. Aureus is one of the most important food poisoning micro - organisms (Naomi and Avraham , 2000) This organism is of major concern to the meat industries (Hannan et al , 2008).

This higher results may be due to contamination during processing from the hands, worker's clothes, knives, the hide, the gut or from the environment resulting in an inferior or even unfit quality for human consumption. Or due to ignorance of workers and butchers by the personal hygiene rules. Moreover, a condition like injured hands or having abscess greatly enhance *Staph. aureus* contamination. *Staph. aureus* can be isolated from meat grinders, knives, saw blades and cutting boards or tables Downes and Ito (2001).

Table (3) show Nearly similar results obtained by Maarouf and Nassif (2008) the incidence of *Staph. aureus* were 35.4% , Tassew et al., (2010) who found that the incidence of *Staph. aureus* were 12.1%, Lamada et al., (2012) who found that the incidence of *Staph. aureus* were 35.4% in examined samples. Morshedy et al., (2013) who mentioned that the mean value of *Staph. aureus* were 4.3×10^2cfu/g. Abdel Salam et al., (2014) who recorded that the incidence of *Staph. aureus* was 35.4%, Bughti et al., (2017) *Staph. aureus* detected in the examined samples.

However higher findings were obtained by Salek (2000) who found that 28 out of 61 samples were *Staph. aureus*, Naka et al., (2006) who reported that the incidence of *Staph. aureus* were 65% in examined minced meat, Erdema-Ayten et al., (2014) who found that high incidence of *Staph. aureus* 96.6% with the mean value was 3.7×10^6cfu/g, Gwida et al., (2014) who recorded high incidence of *Staph. aureus* 48%, Ragab et al., (2016) the mean value of *Staph. aureus* were 3×10^3cfu/g. Mohamed and Alwan (2017) who detected *Staph. aureus* in 64% from frozen samples and 50% from fresh samples.

While lower results obtained by El Taher – Amna (2009) and Goja et al., (2013) who isolated staph. aureus from the examined samples. Attalla and Kassem (2011) who recorded that the mean value of *staph. aureus* count were 3.94 ± 0.16 $\log_{10}$. Iraha et al (2011) who recorded that the incidence of *Staph. aureus* was 1.3%, El Kewaiky and Al Said (2015) who found that the mean value of *Staph. aureus* were 5.26 ± 4.7 log10 in examined fresh samples and 4.4 ± 3.88 log10 in frozen samples. Tarabees et al., (2015) the incidence of *Staph. aureus* were 20% in examined samples. Shaltoot et al (2016) the incidence of *Staph, aureus* was low and the mean value was 2.2 ± 0.07 log10 in examined samples, Azage and Kibret (2017) who found that the mean value of *Staph. aureus* 3.88 $\log_{10}$cfu/g.

The *Staph. aureus* intoxication is a worldwide problem where several food poisoning outbreaks were reported due to consumption of meat and meat products contaminated with these organisms. Accordingly, the total *Staph. aureus* count can be taken as index of sanitary. conditions under which the meat and its products are manufactured and handled Potter (2001). And the amount of *Staph. aureus* in the food depended on several factors including number of contaminated carriers, poor hygiene handling of the food by workers, respiratory secretion ,also transport system Porpino et al (2015), Rahimi - Alang et al. (2011).

According to Egyptian Organization for standardization EOS (1694/ 2005) It has

been proposed that the minced meat must be free from *Staph. Aureus.*

Total Coliforms count (cfu/g) of the examined fresh and frozen minced meat samples:

The prescence of coliforms group has an epidemiological interest as some of the members are pathogenic,

the high incidence of coliform may be due to inadequate cleaning and disinfection, contaminants materials (packaging), bad condition of storage, source of untreated water, or non – compliance with decontamination protocol, lack of precautions or cross contamination as well as the contribution of contamination during the transport of the carcasses in butchers the break of the cold chain or during the mincing process for the minced meat Guemour et al., (2015).

Table (4) show Nearly similar results obtained by Al – kour (2001) who recorded that the mean value of total coliform count was $2.34 \times 10^3 \pm 0.82 \times 10^3$cfu/g, Okonko et al ., (2010) who found that the mean value of total coliform count ranged from 1.23×10^3 to 3.42×10^3cfu/g , Salem – Amany (2010) who recorded that the mean value of total coliform count was 5.1×10^3cfu/g .

However higher findings were obtained by Aslam et al., (2000) who found coliform in all examined samples , Datta et al., (2012) , Erdema – Ayten et al., (2014) who recorded high incidence of coliform 96.6% with mean value of 4.5×10^7cfu/g, and Mohamed (2017) recorded that there were high incidence of coliform 53.6% in examined samples.

While lower results obtained by El mali and Yaman (2005) who recorded that the mean value of total coliform count was 2×10 cfu/g, Bouzid et al., (2015) isolated coliform from 3.89% of samples, El Kewaiky and Al said (2015) who found that the mean value of total coliform count was 4.57 ± 4.26 log10 in fresh samples and 3.93 ± 3.64 log 10 in frozen samples, Guemour et al., (2015) isolated coliforms from 3.89% of samples, Shaltoot et al., (2016) who recorded that the mean value of total coliform count $3.1 \pm 0.1 \log_{10}$, Zafer (2016) isolated coliform from 9 samples, and Bughti et al., (2017) who recorded that the mean value of total coliform count 3.97 $\log_{10}$.

There is a Significant difference between the examined frozen and fresh minced meat samples ($P > 0.05$).

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