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Quality Assurance of Some Meat Products

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ABSTRACT

A grand total of 75 random samples of meat products were collected from different local supermarkets classified into 25 samples each of minced meat, beef burger and luncheon, these products were subjected to organoleptic evaluation, determination of *APC*, *Enterobacteriaceae*, *Staphylococcus aureus* counts and incidence and serologically identification of *E.coli* count as well as isolation of *salmonellae* isolates. as well as isolation of salmonellae. Results revealed that minced meat contained the higher mean values of *APC* (CFU g) ($3.3\times 10^5 \pm 1.6\times 10^5$), The obtained results revealed that minced meat contained the higher, while the lower one was reported in Luncheon ($2.3\times 10^3 \pm 8.6\times 10^2$), *E.coli* count in beef burger products revered higher incidence (20%). While the lower incidence (12%) was in minced meat. in addition, the incidence of isolated *E.coli* serotypes from minced meat was (16%) , while the incidence of beef burger and luncheon were (12%) of each. Furthermore total *staphylococcus* count was higher in minced meat ($0.\ 2x10^2 \pm\ 0.\ 13x10^2$) and lower in luncheon ($<10^2$), beef burger had higher values of *Enterobacteriaceae* count ($7.12x10^2 \pm 2.5x10^2$), while lower value in minced meat ($4.27x10^3 \pm\ 1.2x10^3$).

Higher incidence of *Salmonellae* in the examined meat product samples have been showed in minced meat (24%). While lower incidence (12%) was in luncheon and beef burger . Regarding *Salmonellae* Haifa not recorded in minced meat but was isolated from beef burger and luncheon (4%) of each. Higher appearance of *salmonellae Enteritidis* in minced meat (8%) and not isolated from luncheon, while of *salmonella Ttyphimurium* was 16% in minced meat, 4% in beef burger and 8% in luncheon .

Higher pH value (5.9±0.086) was reported in luncheon, while Higher TVN and TBA value were 24.69±2.045 and 0.70±0.070 in luncheon and minced meat, respectively. The public health importance of isolated strain were discussed

I. INTRODUCTION

Meat and meat products are considered as an excellent source of high-quality animal protein, vitamins especially Vit.B complex, and certain minerals especially iron (Gracey et al., 1999). They are considered as an ideal culture medium for growth of many organisms because they are high in moisture, rich in nitrogenous compounds of various degrees of complexity, plentifully supply with minerals and accessory growth factors, have some fermentable carbohydrates (glycogen) and of a favorable pH for most microorganisms.

Contamination of meat products by bacteria can be due to poor sanitation applied in the factories, the poor technology adopted and more manual handling of the product.

Meat and meat products are considered as a major vehicle of most reported outbreaks of food borne diseases. Epidemiological data have identified improperly handled meat products as important vehicles for infection (ICMSF, 1980).

Meat products may be contaminated by pathogenic microorganisms during the processes of manufacturing, packing and marketing. Improper cooking, refrigeration or storage may lead to meat borne illness.

Color, odor and flavour of meat products are important indicators for the consumer's acceptability to these products, success in having and applying good series of technologies result in a product with a desirable organoleptic attribute (Deng and Fratamico, 1996). *Staphylococcus aureus* in raw

minced meat may be from air and personnel who can get into the equipment and contaminate foods. *Staphylococcus aureus* produce a wide variety of toxins including Staphylococcus enterotoxins with emetic activity and a major cause of food poisoning, symptoms are of rapid onset and include nausea and violent vomiting, with or without diarrhea. This illness is severe enough to warrant hospitalization (Argudin et al., 2010). *Salmonella* infection is one of many possible causes of gastroenteritis and symptoms including fever, diarrhea, loss of appetite, headache, stomach cramps , nausea and vomiting (Rebecca et al ., 2006). Therefore, this study was carried out to evaluate some locally processed meat products in minced meat, beef burger and luncheon) under the aspect of :

1- Organoleptic evaluation

Evaluation of color, odour and taste.

2)-Bacteriological evaluation:

- ***Aerobic plate count*.**
- ***Enterobacteriaceae* count.**
- ***Staphylococcus aureus* count.**
- **Isolation and identification of *E.coli***
- **Isolation and identification of *Salmonellae*.**

3) - Chemical evaluation:

- **Determination of pH.**
- **Determination of Total Volatile Nitrogen (TVN).**
- **Determination of Thiobarbituric number (TBA).**

II. Material and Methods

2.1 Collection of samples:

A total of 75 random samples of meat products represented by 25 each of luncheon, frozen minced meat and beef burger were collected from different supermarkets at Cairo and Benha cities to be examined organoleptically, bacteriologically and chemically .Each sample was packed in astrile plastic bag and transferred as rapidly as possible to the laboratory in an ice box with a minimum period of delay and subjected to the following examination :-

2.2 Organoleptic examination

The samples were sensory evaluated for colour, odour and flavour according to **(Marriot (1995).**

2.3. Bacteriological examination: -

2.3 .1. Sampling preparation:

Twenty - five grams from each sample were taken under aseptic conditions using sterile scissor and forceps and mixed after using sterile homogenizer (MPW0302, Poland) with 225 ml of sterile buffered peptone water (0.1%) for 2 minutes at 1500- 2000 rpm . to provide dilution of 10^{-1} then decimal serial dilutions were prepared.

2.3.2. Determination of *Aerobic plate count* according to Swanson et al . (1992).

2.3.3 Determination of *Enterobacteriaceae* count:

The drop plate method recommended by ICMSF (1978) was applied using violet red bile glucose agar.

2.3.4. Determination of *Staphylococcus aureus* count according to FAO (1992).

2.3.5. Isolation and identification of *E. coli* according to ICMSF (1978).

2.3.6. Isolation and identification of *Salmonellae* according to Vassiliadis et al (1983).

3. Serological identification:

3.1. Serological identification of the isolated *E.coli* according to **Sojka (1965):-**

3.2. Serological identification of *Salmonellae* according to Kauffman white schemes **(Kauffman , 1974).**

4. Chemical Examination

Determination of:

1. **pH values (Pearson, 2006).**
2. **Total Volatile Nitrogen (TVN) (FAO, 1980).**
3. **Thiobarbituric Acid Number (TBA) (Pikul et al., 1989).**

3-Results and discussion

Meat products are highly demanded due to their high biological value, reasonable price, agreeable taste and easy to be served, Meat products are considered as an excellent source of high quality protein, minerals and vitamins (Lawrie, 1998). Palatability and acceptance by the consumer is a relative preference which may be variant from one person to another as off flavors, however may be serious to some consumers, yet others may find such flavors desirable (Gray et al.,1994).

Table (1) revealed that the acceptable samples of color, odour and flavor of minced meat samples were 20 samples (80%), 21 samples (84%) and 20 samples (80%) respectively. While the acceptable samples in beef burger, were 18 samples (72%), 21 samples (84%) and 21 samples (84%). In add to luncheon, the acceptable samples for color were 21 samples (84%) , for odour 18 samples (72%) were acceptable and 18 samples (72%) were acceptable for flavor . Nearly similar results were obtained by Samir (2016) regarding the color and odour.

The incidence of undesirable products as reported in table (1) is due to shortage in the above-mentioned technology. As well as the use of long stored frozen beef , Bhalla,1985) and Hunt and Kropf ,1987). Furthermore, bacteriological contamination of the meat products may be due to poor sanitation applied in the factories, poor technology adopted, more manual handling of the product and manual filling and absence of the tunnel freezing of the product which may reduce the propagation of bacteria during the phase of preparation (Ayres, 1960 and Niven, 1989).

Table (1): Organoleptic evaluation of meat product samples (n=25).

Organoleptic / Samples	Colour				Odour				Flavour			
	accepted		unaccepted		accepted		unaccepted		accepted		unaccepted	
	No	%	No	%	No	%	No	%	No	%	No	%
Minced meat	20	80	5	20	21	84	4	16	20	80	5	20
Beef burger	18	72	7	28	21	84	4	16	21	48	4	16
Luncheon	21	84	4	16	18	72	7	28	18	72	7	28

Table (2): Mean values of *APC*; *Enterobacteriaceae* and *Staphylococcus aureus* count (CFU/g) in the examined meat product samples (n=25).

Samples	APC	*Enterobacteriaceae*	*Staphylococcus aureus*
Minced Meat	$3.3\times 10^5 \pm 1.6\times 10^5$	$4.27x10^3 \pm 1.2x10^3$	$0.\ 2x10^2 \pm 0.\ 13x10^2$
Beef burger	$1.6\times 10^4 \pm 9.7\times 10^3$	$7.12x10^2 \pm 2.\ 5x10^2$	$0.\ 1x10^2 \pm 0.\ 11x10^2$
Luncheon	$2.3\times 10^3 \pm 8.6\times 10^2$	$5x10^2 \pm 3x10^2$	$0.\ 3x10^2 \pm 0.\ 12x10^2$

Table (3: Incidence and serotyping of *isolated of E.coli* of examined meat product samples (n=25).

Samples	Positive		O26: H11		O86		O124		O55: H7		O127:H4	
			EHEC		EPEC		EIEC		EPEC		ETEC	
	No	%	No	%	No	%	No	%	No	%	No	%
Minced meat	4	16	2	8	1	4	1	4	0	0	0	0
Beef burger	3	12	0	0	0	0	0	0	2	8	1	4
Luncheon	3	12	0	0	1	4	0	0	0	0	2	8

***EPEC**:-Enteropathogenic E.coli, **EIEC**:- Entero invasive E.coli, **ETEC**:- Entero toxigenic E.coli, **EHEC**:- Enterohaemorrhagic E.coli.*

Table (4): Acceptability percent of *APC* and *E.coli* in the examined meat product samples for each parameter according to E.O.S. (2005)

Acceptability / Samples (n=25)	APC/g limit $\leq 10^6$				E.coli/g limit Free			
	Accepted		Unaccepted		Accepted		Unaccepted	
	No	%	No	%	No	%	No	%
Minced meat	18	72	7	28	22	88	3	12
Beef burger	25	100	0	0	20	80	5	20
Luncheon	20	80	5	20	21	84	4	16

Table (5): Incidence of *Salmonellae* in the examined meat product samples (n = 25).

Samples	Positive		*S. Haifa*		*S. enteritidis*		*S. typhimurium*	
	No	%	No	%	No	%	No	%
Minced meat	6	24	0	0	2	8	4	16
Beef burger	3	12	1	4	1	4	1	4
Luncheon	3	12	1	4	0	0	2	8

Table (6): Chemical determination of examined meat product samples (n=25).

Samples		pH	TVN	TBA
Minced meat	**Min**	**5.1**	**15.5**	**0.14**
	Max	**7**	**51.8**	**1.5**
	Mean -+ SE	**5.89±0.095**	**24.69±2.045**	**0.70±0.070**
Beef Burger	**Min**	**5.1**	**12.6**	**0.15**
	Max	**6.5**	**25**	**0.65**
	Mean -+ SE	**5.8±0.067**	**17.01±0.59**	**0.44±0.028**
Luncheon	**Min**	**5.1**	**10**	**0.08**
	Max	**6.6**	**35**	**0.62**
	Mean -+ SE	**5.9±0.086**	**22.01±1.35**	**0.25±0.028**

TVN = Total Volatile Nitrogen. **TBA** = Thiobarbituric Acid Number

The results recorded in table (2) showed that For minced meat, the mean values of *APC* of the examined minced meat was $3.3x10^5 \pm 1.6x10^5$, lower results ($8.20x10^2$) were reported by El- Shamy (2015), while *Enterobacteriaceae* was $4{,}7x10^3 \pm 1.2x10^3$, in add to *Staphylococcus aureus* was $0.2x10^2 \pm 0{,}13x10^2$ in examined minced meat samples , The obtained results were lower than those reported by Eleiwa (2003) ($7.45x10^3$) and Al-Kour (2001) ($4.13x10^3$), nearly similar results were obtained by Hassan (2001) (2,8x10). while in beef burger the mean value of *APC* was $1{,}6x10^4 \pm 9{,}7x10^3$, , Higher results were recorded by EL- Mossalami (2003) (9 $x10^2$) and Zaki (2003) (9 $x10^2$) , while *Enterobacteriaceae* was $7.12x10^2 \pm 2.5x10^2$, lower results ($8.20x10^2$) were reported by El- Shamy (2015), for *Staphylococcus aureus* was $0.1x10^2 \pm 0.11x10^2$, , in add to the mean value for APC in luncheon samples was $2.3x10^3 \pm 8.6x10^2$, Higher results were reported by EL-Shamy (2015) (6.29 $\times 10^2$) and Ashraf (2016) (8.9 $\times 10^3$), while *Staphylococcus aureus* was $0.3x10^2 \pm 0.12x10^2$, Higher results were reported by Ashraf (2016) (1.1$\times 10^3$), furthermore *Enterobacteriaceae* count was $5x10^2 \pm 3x10^2$, The obtained results were nearly similar to those reported by El-Shamy (2015) (4.65$\times 10^2$) and higher results were reported by Sherif (2017) (1.56$\times 10^3$ Ashraf (2016) (1.2$\times 10^3$) and Samir (2016) (1.35$\times 10^4$).

Moreover for table (3) the obtained results revealed that incidence of *E.coli* which isolated from the examined samples were 16% from minced meat , the obtained results were similar with those reported by Salah (2001), while for beef burger was 12%, The obtained results regarding the number of positive samples were lower than the results Mosbah(2017) (36%) ,Ramadan (2015) (40%). For Lunchon samples was isolated from 12% from each., Nearly similar results were reported by El -Shabrawy(2015)(8%) while ,higher results were reported by Mosbah (2017) (24%) ,Ramadan (2015) (28%) and Ashraf (2016) (36%), Regarding serotyping of isolated *E.coli* of the examined minced meat samples were O26:H11 (EHEC) (8%), O86 (EPEC) (4%) and O124 (EIEC) (4%) , while O55:H7 (EPEC) and O127:H4 (ETEC) isolated from 8% and 4% from Beef burger, in add to in Luncheon samples O127:H4 (ETEC) had been isolated from 4% from examined samples .

As recorded in table (4) the acceptability of *APC* (accordance with E.O.S. (2005) was -$^{<}10^6$ APC/ g) , the table revealed that unaccepted samples of the examined samples of minced meat was 28%, higher results were reported by El- Shabrawy, (2015) who said that 100% of the examined samples of minced meat were above the permissible limits, while all examined beef burger sample were unaccepted samples (0%) , The obtained results were lower than the results Mosbah(2017) (36%) ,Ramadan (2015) (40%).in add to in Luncheon meat samples unacceptable samples of *APC* were 20%, the result lower than El -Shabrawy(2015) (52%), Moreover the unacceptable samples of *E.coli* (accordance with E.O.S. (2005) was limit free) , the result obtained in the table recorded that for the examined minced meet was 12% , the obtained results were similar with those reported by Salah (2001), while 20% for beef burger, lower results were reported by El -Shabrawy(2015)(8%) while higher results were reported by Mosbah (2017) (24%) ,Ramadan (2015) (28%) and Ashraf (2016) (36%). For Luncheon meat samples unacceptable samples of *E.coli* in luncheon was 16%, Nearly similar results were reported by El -Shabrawy(2015)(8%) while , higher results were reported by Mosbah (2017) (24%) ,Ramadan (2015) (28%) and Ashraf (2016) (36%), associated with food borne illness were classified into 4 categories, Enteropathognic *E.coli* (EPEC),

Enterohaemorrhagic *E.coli* (EHEC) ,Enterotoxigenic *E.coli* (ETEC) and Enteroinvasive *E.coli* (EIEC) (Doyle,1990).

Regarding table (5) recorded that the incidence of Salmonellae which isolated from the examined meat product samples were 24% from minced meat samples , the obtained results were higher than those reported by Bosilevac et al. (2009) (4.2%) and Filliol et al. (2008) (2.8%) , while in beef burger was 12%, lower than the results which obtained by Mosbah (2017) (8%) , higher results were reported by Ramadan (2015) (16%) and EL– Shamy (2015) (20%) and for Luncheon samples was 12%, lower than the results which reported by Mosbah (2017)(4%) ,El- Shabrawy (2015 (4%) and Ramadan(2015) (4%) , while higher results were reported by Ashraf (2016) (20 %) and El-Shamy (2015) (26%) , in add to recorded that Salmonellae species which isolated from the examined samples were *S.haifa*, *S.enteritidis* and *S.typhimurium* which isolated from 4% from each in beef burger samples , Moreover *S.enteritidis* and *S.typhimurium* were isolated from 8% and 16% from examined minced meat samples, furthermore for Luncheon meat only *S.haifa* and *S.typhimurium* isolated from 4% and 8% from examined samples respectively .

Lastly for chemical examination of minced meat, It is evident from table (6) that The mean value of pH ,TVN and TBA were 5.89±0.095, 24.69±2.045 and 0.70±0.070 , respectively. EL-Shabrawy (2015) reported nearly similar results regarding to pH (5.63) and lower results regarding TVN (5.23) and TBA (0.10) and Kortoma (2016) reported nearly similar results regarding to TBA (0. 67) and higher results regarding TVN (12.60). For beef Burger , Furthermore the mean value of pH ,TVN and TBA were 5.8±0.078, 17.01±0.59 and 0.44±0.028, respectively. Nearly similar results were reported by Mohamed (2002) regarding to pH (5.7) , TVN (15.9) and TBA(0.64) .While for luncheon the mean value of pH ,TVN and TBA were 5.9±0.086 , 22.01±1.35 and 0.25+0.028, respectively .Samir (2016) reported nearly similar results in regards to pH (13.37) and TBA (0.18) while , reported higher results in regards to TVN (13.37) . The increase in values of TVN might be attributed to post processing circumstance particularly at shop level (Cross et al., 1986).

4- CONCLUSION

Color, odor and flavor of meat products are important indicators for the consumer's acceptability of these products, the success in having and applying good series of technologies result in a product with the desirable organoleptic attributes.

Contamination of meat products by bacteria may be due to the poor sanitation applied in the factories, the poor technology adopted, manual handling of the product during filling and absence of the tunnel freezing of the product.

The pH value, as well as TVN estimation and TBA collectively are requested for quality assurance of the meat products and could be act as indicator of the quality of such meat.

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