

THE BACTERIOLOGICAL QUALITY, FAT AND COLLAGEN CONTENT OF Minced MEAT

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ABSTRACT

Fifty samples of minced meat were collected from different localities at Sohag Governorate. The collected samples were transported to the laboratory on ice box to be examined bacteriologically for A.P.C., Bacillus cereus count, Staphylococcus aureus and Streptococcus faecalis. The mean values of the aforementioned microorganisms were 8.1×10^4 ; 2.1×10^6 ; 8.1×10^4 and 5×10^3 microorganism/gram for the examined samples respectively. Moreover, other bacterial species were isolated and identified. Fat, collagen and moisture contents in the examined samples ranged from 16.5 – 30.3% for fat; 1.7 – 4.1% collagen while moisture ranged from 53 – 68.1 in the examined samples. Measures to improve product quality were discussed. The public health importance of existed microorganisms as well as the recommended methods to improve the sanitary status of the product to prevent their rapid spoilage were mentioned.

INTRODUCTION

The bacteriological quality of meat at retail is relatively poorly documented in the scientific literature. Concern that minced meat might be a cause of food borne illness has prompted interest in the numbers and types of bacteria commonly occurring in it. Minced meat is a very common and popular processed meat product manufactured from lower

value minced meat to produce higher value products. Food additives are used to accomplish certain function and altered flavor. Where it is a good source of protein and of low price. The meat is easily cured and the high protein content provides good caloric value. Also processed products from meat are cheap. *Mahmoud et al., (2004)* stated that the bacteriology of meat and products are very scanty.

Isolation and enumeration of the microorganisms present in foods usually demands preliminary treatment of samples to release into a liquid medium those microorganisms present that may be included within the food (*Anavella, 2001*).

Meat is subjected to contamination with several types of microorganisms, from different sources from the time of slaughter till consumption. Such contamination may render the product of inferior quality or even unfit for consumption, thus; resulting in economic losses and at times may constitute a public health hazard. Human food poisoning is commonly associated with bacteria originating from animal sources, in most cases; infection is contracted directly by eating meat and meat products. Such contamination may occur in the slaughter houses or during processing and handling or post cooking.

So this study was done to investigate the bacteriological quality of fat and collagen content of minced meat.

MATERIAL AND METHODS

Fifty random samples from minced meat each 250 gm weight were collected from different localities in Sohag city and transferred to the laboratory under strict hygienic measures where they were subjected to bacteriological examination.

Minced meat homogenate was prepared according to *Thatcher and Clark (1975)*. Total colony count (*A.P.H.A., 1972*), *Bacillus cereus* count (*Barraued et al., 1967*), *Staphylococcus aureus* count (*Thatcher and Clark 1978*) and Total *Streptococcus faecalis* count (*Efthymiou and Joseph 1974*) were carried out. Isolation of other members of enterobacteriaceae organisms was done according to *Cruickshank (1972)*. *Bacillus cereus* was identified according to *Cowan and Steel (1974)*. Biochemical tests for identification of the isolated were carried reactions according to *Cowan and Steel (1974)*.

Moisture and fat determination:

Ten samples were collected from minced meat at retail shops three times consequently with a week intervals, samples were thoroughly mixed and sub-sampled for moisture and fat determination according to *Roberts et al., (1980)*. For moisture, 12-15g of sample was weighed to the nearest milligram, freeze-dried and finally dried to constant weight in a vacuum oven at 70°C.

For free fat, 8- 10 g of sample was freeze-dried and extracted for 8h in a Soxhlet apparatus using 40°-60° petroleum spirit. The extracted fat was expressed as a percentage of the fresh weight of the sample. Although there are two appropriate BSI/ISO methods for 'total fat' or 'free fat', the meat trade prefers the free fat method because it involves less manipulation of the sample. The total fat method can give values up to Ca. 1% higher than the free fat method, but where fat levels are Ca. 15-25 % the difference is relatively unimportant.

Collagen content:

It is measured according to *Hudson et al (1986)*.

RESULT AND DISCUSSION

Total number of viable aerobic bacteria in food is generally used to determine food quality; this producer is based on the assumption that each microbial cell in a sample will form a visible separate colony when mixed with agar medium and permitted to grow (*Ward, 1977*).

Table (1) showed that the mean Aerobic plate count in examined samples ranged from 4.6×10^3 to 3.2×10^5 with a mean value 8.1×10^4 cfu/gram it indicates the contamination of ingredients due to unsanitary conditions during handling, processing and distribution as well as the influence of high storage temperature that accelerate the existing organisms. Nearly similar finding were noticed by *Hudson et al., (1986)* and *Mahmoud et al., (2004)*.

These microorganisms can cause off flavors and physical defects in foods. Their presence indicates a high potential for spoilage during extended storage. (*Griffiths et al., 1981*). Most of these microorganisms are destroyed by mild heat treatment, but some heat-resistant types such as some species of *Bacillus* and *Clostridium*. The presence of psychrotrophic microorganisms in heat-processed foods implies post-processing contamination, which act as a sources of heat-resistant proteolytic and lipolytic enzymes.

The results obtained in table (1) pointed out that all minced meat samples from ground meat were high in *Bacillus cereus* count which ranged from 6×10^3 to 3.4×10^6 with a mean value of 2.1×10^6 cfu/gram . Higher results were obtained by *Mahmoud et al., (2004)*.

Bacillus cereus is a highly pathogenic microorganism and may cause food poisoning they can grow well at a wide range of temperature (25-75°C) and at pH value from 6-7. Their spores are very resistant to heat and its growth is inhibited at pH lower than 4. This species is highly lipolytic, saccharolytic and proteolytic. It may be present on flour, milk, dairy products, rice, chicken, spices, and herbs. Only total absence of this species is normally accepted by legal regulations (*Cliver, 1990*).

Also *Staphylococcus aureus* counts ranged from 6×10^4 to 2×10^5 cfu/ gram with a mean value 8.1×10^4 in the examined sample respectively. The presence of *S. aureus* in a number of examined samples suggested that the poor personal hygiene of food handlers as the organisms originate from suppurating lesion or from the nostril of a carrier *Elwi (1994)*.

Staphylococci produce heat-resistant toxins that act at the digestive level. There are seven kinds of enterotoxins, A, B, Ch C₂, C₃, D, and E. Toxins A and D are more frequently present in food intoxication. *Staphylococcus aureus* may cause skin infection (acne). Staphylococci could be present in, e.g., dairy, meat, sausages, fish, and eggs.

Generally it is noticed, from the obtained results that all bacterial counts were high. *Bacillus cereus* indicated that the environmental contamination, handlers mincing machines are the main source for its presence and also spices may be another source (*Ahmed, 2002*). It is of basic importance to the manufacture of all processed meat is the selection of proper raw material. Quality of these meat as determined by their chemical and microbiological qualities should be high for it is certainly a truism a finished product can be of no higher quality than the ingredients it contain (*Person and Tauber, 1984*). They are usually kept

in special, dry premises away from the workers, in which they can pre-weighed, blended and packed into plastic bags in the proportions required for product formulation. One of the most important consequences of failure to protect all non meat ingredients is contamination with dirt, excreta from rodents, birds or other animals and infestation with insects (*Cano Munoz, 1992*).

Streptococcus faecalis count (in table 1) ranged from 4.2×10^2 to 3×10^4 with a mean value of 5×10^3 cfu/gram a higher microbes count in the examined samples due to unsanitary measures, improper handling, (*Mahmoud, 2004*).

Bacillus cereus also recorded higher percentage bacterial species isolated in different percentages from all the examined samples (25) were *citrobacter* (16), *Proteus* (17), *Klebsiella* (12), *S. aureus* (6) and *Str faecals* (11). (Table 2). The public health and spoilage significance of these bacterial species reveal the risk on the consumer and bad keeping quality (*Elmaghraby, 2002; Ahmed, 2002; Mahmoud et al., 2004 and Maha et al., 2008*).

The results in table (3) detected that fat content ranged from 16.5 – 30.3%, The high fat content of some minced beef has received adverse publicity, yet the meat trade is sometimes represented to be most reluctant to support the imposition of legally enforceable standards for fat content. A chosen standard must be attainable by good commercial practice. Rapid and accurate control of fat levels is only possible, however, by the use of expensive instrumental methods; for example, the Foss-Let fat analyzer (*AOAC, 1980*) and the CEM analytical system (*Bostian et al., 1985*).

Collagen content ranged from 1.7 – 4.1 and moisture from 53 – 68.1%. Laboratory studies show that mean values of the collagen of muscles from which the muscle sheath and external aggregates of connective tissue have been trimmed lie between 0.5 % in better quality meat such as the loin and 3.5 % in poorer quality meat such as the shin (*Bendall, 1967*). Commercially butchered joints from beef carcasses showed mean collagen values from 1.9% (2.3% wet fat free) in the better quality joints to 4.4% (4.8% wet fat free) in the shin (*Casey et al., 1985*). Note that the collagen content of the mince samples obtained by analysis, when expressed as a percentage of wet tissue, will be affected by the amount of fat in the sample, which, in turn, depends on the amount of fat left on the original cuts of beef. Any added fatty tissue will itself contain varying amounts of collagen. It would therefore be difficult to relate the analytical collagen values for beef minces to any particular commercial cut.

Nearly similar results reported by *Hudson et al., (1986)* who found that fat content of minced beef ranged from 17 – 25% while the collagen in the mince at retail ranged from 1.4% to 4.4% (1.5% to 5.1% in a wet fat free basis). *Ishrak et al., (2004)* suggested that the use of lactic acid bacteria would help preserving fresh minced meat for extended period at 22°C, and has a drastic reduction in SPC coliforms enterococci and Staphylococci. It could be concluded that proper handling, application of sanitary measures, package and storage are the causes for lower bacterial count in the retailed minced meat.

Table (1): Statistical analysis of bacterial count of examined minced meat samples (n=50).

Microorganisms	Minimum	Maximum	Mean
Aerobic plate count	4.6×10^3	3.2×10^5	8.1×10^4
<i>Bacillus cereus</i> count	6×10^3	3.4×10^6	2.1×10^6
<i>Staphylococcus aureus</i> count	6×10^4	5.2×10^5	8.1×10^4
<i>Streptococcus faecalis</i> count	4.2×10^2	3×10^4	5×10^3

Table (2): The incidence of isolated microorganisms from the examined samples.

Isolates	+ve	%
<i>Bacillus cereus</i>	25	50
<i>Klebsiella pneumoniae</i>	12	24
<i>Citrobacter freundii</i>	16	32
<i>Proteus spp.</i>	17	34
<i>Coagulase +ve Staphylococcus aureus</i>	6	12
<i>Streptococcus faecalis</i>	11	22

Table (3): Percentage fat, moisture and collagen in the examined samples

shop	Fat content (%)			Collagen (%)			Moisture content (%)		
	Visit			Visit			Visit		
	1	2	3	1	2	3	1	2	3
1	22.2	24.9	31.1	3.9	2.6	1.9	58.3	61.2	60.5
2	23.4	22.7	24.8	1.7	2.8	3.5	59.6	66.2	62.9
3	30.3	27.4	21.2	3.9	3.3	2.9	68.3	56.4	59.2
4	29.7	22.2	17.6	2.6	3.8	4.1	59.6	57.2	54.9
5	21.3	20.7	24.8	1.8	3.2	2.8	62.3	64.2	53
6	19.3	15.8	16.9	4.4	3.8	3	60.1	62.3	58.4
7	28.1	22.3	18.4	2.8	3.7	4.1	59.2	59.7	57.1
8	19.8	24.1	17.6	3.1	2.7	2.1	62	60.1	56.4
9	19.0	22.1	20.4	2.4	4.2	3.8	60.3	59.2	54
10	22.8	30.1	27.4	1.9	2.8	3.2	68.1	64.2	57.1

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الحالة البكتريولوجية ومحتوي الدهون والكولاجين لحجم المفروم بمحافظة سوهاج

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أجريت هذه الدراسة لمعرفة الحالة الصحية ومحتوي الدهون والكولاجين في اللحوم المفرومة بسوهاج، حيث تم تجميع 50 عينة لفحصها بكتريولوجياً. تم نقل العينات للمعمل في ثلاجة حفظ العينات بأسرع وقت وتم فحص العينات لتحديد العد الكلي للميكروبات الهوائية وميكروب الباسيلس سيرس والعنقودي الذهبي والميكروب السبحي.

وكان متوسط العد الكلي لهذه البكتريا في العينات التي تم فحصها لتلك الميكروبات 8.1×10^4 ، 2.1×10^6 ، 8.1×10^4 و 5×10^3 ميكروب/جرام علي التوالي بحد أقصى 3.2×10^5 ، 3.4×10^6 ، 5.2×10^5 ، 3×10^4 و حد أدنى 4.6×10^3 ، 6×10^3 ، 6×10^4 و 4.2×10^2 ميكروب/جرام علي التوالي.

كما تم عزل ميكروبات الباسيلس سيرس والكليسيلا نيموني وسيتروباكتر فرونداي وبعض أنواع البروتيس والعنقودي الذهبي بنسب تكرارية مختلفة .

كما تم جمع 30 عينة من المحلات من اللحوم المفرومة علي ثلاث مرات أسبوعياً لتحديد محتوى الدهون والكولاجين والرطوبة. ووجد أن نسبة الدهون في العينات المفرومة تراوحت من 16.5% - 30.3%، والكولاجين تراوح من 1.7% - 4.1%، وكانت نسبة الرطوبة من 53% - 68.1%.

هذا وقد تم مناقشة الأهمية الصحية لهذه الميكروبات والتوصيات المطلوبة لتحسين حالة المنتج وسلامته والحفاظ على صحة المستهلك.