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# Meat Examination in the Laboratory, the Acceptability and the Human Health

**Fahim AS***
Department of Food Control, Benha University, Egypt

***Corresponding author:** Fahim A Shaltout, Food Control Department, Faculty of Veterinary Medicine, Benha University, Egypt, Email: fahim.shaltout@fvtm.bu.edu.eg

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## Abstract

As a consequence of the meat market globalization, the production and manufacture of meat products is at a stage of innovative dynamics as meat contains an abundance of proteins with high biological Value, meat is an excellent diet source of essential amino acids. Consumers demand high quality and convenient meat products, with natural flavour and taste, and very much appreciate the fresh appearance of minimally processed meat. To harmonize or to blend all these demands without compromising safety, it is necessary to implement new preservation technologies in the meat industry and in the meat industry. Meat treatment and processing may include protein extraction, chemical and enzymatic treatments, massaging or tumbling, curing, stuffing, canning, smoking, and other related preliminary preparations, such as, meat particle size reduction and mixing of meat with various additives. It is noteworthy that simple handling of fresh meat in retail stores and in homes is generally excluded from the definition of meat processing. By the controlling of the amount of the salt, the sugar, the nitrate or nitrite, and the other ingredients, as well as the curing agents, the dehydration, and the maturation durations, and the proper packaging of the meat products and the storage conditions of the meat product, the meat products can be of high acceptability, fairly stable, and safe. The principles behind these techniques are being revealed by the various scientific studies on the effect of ingredients and processing methodology used in the preparation of these products.

**Keywords:** Human Health; Acceptability; Processed Meat; Meat Treatment; Flavor; Taste

**Abbreviations:** MRS: deMan, Rogosa, and Sharpe; APC: Aerobic Plate Count; TCA: Trichloroacetic Acid

## Introduction

The meat is important to the meat industry and to economies and cultures around the world. The peoples who choose to not consume the meat or other products of animal origin, for some reasons as taste acceptability, the ethics, the environmental factors the health conditions or the religious dietary rules. The meat is mainly composed of the water, the protein, and the fat. The meat is edible raw, but the meat is normally eaten after it has been cooked and seasoned or processed in a variety of the methods. The raw meat may be spoil not rot within few hours or few days due to the contamination with, and the decomposition by, the bacteria and the fungi [1-6]. There is Three Main Meat Groups, the red meat, all livestock is considered red meat. This includes the beef, the pork, the chevon, and the mutton. The poultry, commonly known as the white meat, the poultry includes the

chicken and the turkey. The seafood that includes the fish, as well as the crustaceans like the crab, the lobster, and the molluscs, like the clams, the oysters, the scallops and the mussels. The red meat which includes the beef, the pork and the mutton including the sensory characters, the composition and the examinations could be done on the meat [7-12].

## The Sensory or Organoleptic Characters of Meat

**Meat Colour:** Beef meat is Bright cherry red in color. Mutton meat is Light red to brick red. Pork meat is Greyish pink in colour [13-17].

**Meat Odour:** The raw meat of Freshly Slaughtered Cattle is characterized by a very weak odour. Mutton meat is faint or goat. Pork is urine like in odour [18-22].

**Meat Texture and Meat Consistency:** Beef Meat is coarse with marbling appearance. Mutton meat is firm with Inter muscular fat present. Pork meat is soft in texture, free of surface wateriness with S/C and Intramuscular. The attributes to be evaluated are (appearance, colour, texture and consistency, smell and taste). Texture and consistency (tenderness and juiciness) [23-27].

The meat prepared for the consumption must be tender and juicy. The meat tenderness depends up on the animal species from which the raw meat originated. The mutton, the pork and the poultry meat are tender after the slaughtering but the beef beads a certain time for the maturation to obtain the ideal eating quality. The texture and the consistency of the meat, including the juiciness are important factor, still neglected by the many consumers, for the eating quality of meat. Most of the consumers do not know the eating quality of the meat can be improved by the ripening, especially in the case of the beef and the similar types of meat. Also there is a great deal of the consumer negligence in the methods of preparing the meat. It should be cooked to become sufficiently tender, but cooking should not be too intense otherwise the meat becomes dry, hard and with no juiciness. The texture of meat is influenced by the cook time and temperature.

There is correlation between the meat texture and the heat induced denaturation of the meat proteins was reported for the beef. The texture of the meat is of less importance in the processed meat, such as the cured meat or canned meat products, as sausages, etc., because the meat products are either made of comminuted meat and/or the meat which has undergone the heat treatment or the long maturation periods and will therefore be tender. The heat effects on the meat will also change the water holding capacity of the meat. The meat contains generally 75% water. At the high temperatures greater than 550, myofibrillar proteins denature and coagulate causing shrinkage of fibres and tightening of the myofilaments. This leads to increase in the evaporation and the drip loss and a much drier the meat texture that is less juicy and tender. The texture of the cooked meat therefore depends up on the combination of the intrinsic factors as the water loss, the collagen content and the denaturation of the myofibrillar proteins and the extrinsic factors as the cooking time and the temperature.

1. Techniques used For Estimation of meat Texture: Sensory: The simple way to check the consistency of meat is by chewing. Although this test seems to be easy, in practice it is complicated test. The taste panelists need the experience, especially when the different samples have to be ranked, for example which the sample is the toughest, the second toughest or the tenders. Instrumental methods: are mechanical tests that measure the applied resistance of the meat to a force acting on it [28-33].

## Meat Sample Preparation

1. Fresh coarse ground beef was obtained from a local meat retailer and immediately transported to the laboratory and prepared for testing must be examined as soon as possible [34-40].
2. NaL and NaCl are the salts used for treatment of the ground beef. The hound meat was divided into four batches (two kg each), which was formulated to contain NaL (thirty g/kg), NaCl (thirty g/kg), combination of NaL+NaCl (twenty g+twenty g/kg), or no additives the control. The salts were added to the meat sample (w/w) on the wet weight basis, and since the aqueous solution of NaL was used, all other meat batches were formulated to contain the same amount of water. The salts were thoroughly mixed into the ground meat by the hand, reground through a 0.3cm grinder plate, and divided into one hundred.
3. g samples. Each sample was vacuum-packaged in a polyethylene bags, labeled, and stored at 2°C. The ground beef was sampled at three days intervals during twenty one days of storage for the microbiological and the chemical examination.

## The Microbiological Analyses

**Aerobic Plate Count (APC):** Determined by the inoculation 0.1 ml of the sample homogenate, at the selected dilutions, onto the duplicate sterile plates of the pre-poured and the dried Standard Method Agar by using the surface spread method, then the plates were incubated for two days at 35°C [41-46].

**Psychotropic Count:** Determined in a similar method to that for APC except that plates were incubated at 7°C for 10 days [47-53].

**Lactic Acid Bacteria:** [54-59] The diluted samples were plated on deMan, Rogosa, and Sharpe (MRS) agar and incubated at 30°C for 2–3 days in an anaerobic jars with

disposable Anaerocult C bags for the generation of an anaerobic medium.

**Enterobacteriaceae Count:** One ml of the appropriate dilution was inoculated by the pour-plated technique on the violet red bile agar and overlaid with approximately five ml of the same growth medium, and then the plates were incubated at 35°C for one day [60-66].

## The Chemical Analysis of Meat

**The Nutritive Value of Meat:** The nutritive value includes: proteins, fats, carbohydrates, vitamins and minerals. Beef meat is: 21.5% protein, 69.5% Moisture, 8.0% Fat, 1.0% Ash, 70mg/100g Cholesterol, 160 Kcal Energy. Mutton meat is: 19.5% protein, 71.5% Moisture, 7.0% Fat, 1.5% Ash, 70mg/100g Cholesterol, 145 Kcal Energy. Pork meat is: 19.5% protein, 60.5% Moisture, 9.5% Fat, 1.0% Ash, 70mg/100g Cholesterol, 170 Kcal Energy. Meat is Rich in lysine content, 8 Essential AA- phenylalanine, valine, tryptophan, threonine, methionine, leucine, isoleucine, and lysine. Good source of Iron an essential nutrient for maintaining good health. Meat is rich in Vitamin B12, Vitamin D [67-72].

1. Fat content of meat before the storage, the fresh ground beef was examined for the fat content [73-79].

**Meat Keeping Quality Tests**

1. Detection of Total Volatile Nitrogen in meat: The direct methods the biogenic amines are determined by using the chromatography colorimetric or the combined methods, as the gas chromatography mass spectrometry method. TVB-N determination measures the concentration of ammonia, TMA, and DMA and is perceived as a reflection of the level of protein decomposition and therefore quality deterioration of meat [80-85].

Indirect/rapid methods For the determination of TVB-N Unlike conventional methods used for the determination of TVB-N, noninvasive and nondestructive methods have attracted much interest due to their high reliability, being used directly on the sample without the need to conduct sample preparation, and because of their fast and simultaneous determination of several properties. Several methods have been reported for this purpose, including the computer vision and the infrared spectroscopy. Due to the high interest in the biological effects of TVB-N and TMA on the quality of meat products and on the human health, a new generation of rapid methods of determination have been proposed Many of these methods have been described as inexpensive, safe, rapid, and nondestructive options for rapid detection of TVB-N and unsafe levels of bacteria spoilage. Since loss in meat quality due to bacterial activity also causes changes in the internal and external physicochemical attributes they collect information on changes in the multiple properties, which could provide a better strategy for the measurement of freshness. Therefore, sensors that are capable of detecting certain substances and products of the biochemical or the microbial activities have been developed to detect the freshness of the meat.

2. Thiobarbituric acid detection Thiobarbituric acid as an Index of Oxidative Rancidity in Muscle meat the most common chemical measurement of lipid oxidation in meat is the thiobarbituric acid (TBA) assay. The widespread use of the Thiobarbituric acid assay is primarily due to its simplicity. However, the thiobarbituric Acid test may pose many challenges due to its relative non-specificity and varying sensitivity. The problems can reduce any advantages of the simplicity, and can lead to a misinterpretation of the results unless the factors which affect the TBA reaction are thoroughly accounted and understood. The Thiobarbituric acid assay is based on the reaction between Thiobarbituric acid and carbonyls to form the red, fluorescent adducts under the acidic conditions. The Thiobarbituric acid assay can be conducted on the ground meat, the meat extracts, and the meat distillates. The adduct formation can be conducted under a number of varying temperature (25 to $100^0$C) and the time (fifteen min to twenty hrs.) protocols [86-93].

3. Meat PH measurement Ten grams of the sample were homogenized with 40ml of the distilled water in a blender for thirty's. The homogenate was filtered and the pH value of the filtrate was determined by using a digital pH meter standardized at the pH four and seven [94-100].

4. The Tools for the Measuring of the pH the Mandatory Tools: pH meter Electrode(s) (aka probe or sensor) (if not integrated or included with meter) Electrode fill solution (for re-fillable electrodes). Calibration buffer solutions cleaning solution(s) Storage solution Deionized/Distilled water Kim Wipes.

5. Lipid Oxidation Measurement [101-106] Determined by the Thiobarbituric acid assay. Ground beef (10g) was mixed with twenty five mls of the trichloroacetic acid (TCA) solution and homogenized in a blender for thirty s. After the filtration, two ml of the filtrate were mixed with equal amount of the aqueous solution of the Thiobarbituric acid (3g/l) in a test tube. The tubes were incubated at the room temperature in the dark for twenty hours; then the absorbance was measured at 532nm by using the UV-vis spectrophotometer. The Thiobarbituric acid value was expressed as mg malonaldehyde per kg of meat.

### Chemical Residues in Meat

A residue is defined as a substance having a pharmacological action and of a conversion products thereof and other substances transmitted to meat and which are likely to be dangerous to the human health.

**Antibiotics Residues in Meat:** They produce unsightly lesions when administered by injection. The sight of the injection is discolored, and may be hemorrhagic if treatment was administered shortly before slaughter. In many of these cases the antibiotic is still present in an un metabolized form. Long standing injection sites, particularly those incorporate an oily base, may be hard fibrous nodules within a muscle. During the meat inspection all the carcasses with injection sites should be retained and judgments made according to the case history, the time of treatment and the laboratory examination results. Frequently, there is no case history of the previous treatment, so the best evidence on which to base a judgment is the visual examination of the lesion and the laboratory result [107-112]. The antibiotics may be interfere with further meat processing if this depends up on the fermentation reaction. The antibiotics may cause allergic reactions in the sensitized consumers. A small number of antimicrobials are suspected of having carcinogenic properties. There is also considerable concern regarding the creation of resistant bacteria in farm animals which may then pass to the consumer.

**Hormonal Residues in Meat:** Hormones have been used for a variety of therapeutic and growth –modifying purposes in animals. They may be associated with cancer. The most commonly cited example is diethylstilbestrol therapy given to pregnant mothers with threatened miscarriages. A significant proportion of girls born after this therapy subsequently developed cervical adenocarcinomas [113-118].

**Pesticides Residues in Meat:** Pest control chemicals must be toxic to some living organisms to fulfill their role. Depending on the pest being controlled they may be termed insecticides, fungicides, etc. The insecticides that are directly applied to food animals and the anthelmintic are regarded as the most important subgroups: The chlorinated hydrocarbons, they are frequently more toxic in small amounts as their biological activity is greater [95-99].

**Heavy Metal Residues in Meat:** Excess intakes of heavy metals in meat have caused much intoxication in man. These are most often caused by contaminated cereals or by accidental additions during processing but occasionally toxic concentrations occur in animal tissues and products. These can be associated with soils naturally high in the element or through environmental contamination from local industry. They may also occur from feeding grain treated with the toxic metal or from excess amounts remaining in the environment following previous use in paints, etc. These toxic chemicals are detected by atomic absorption spectrometry [5-11].

- **Lead:** Lead can accumulate in the tissues of animals grazing close to smelting plants or in animal ingesting paints or substances with high lead contents. During chronic exposure the metal accumulates in the bones but in more acute exposure the highest values are found in the liver and kidney.
- **Arsenic:** is the second most important poisonous hazard for farm animals. They may be exposed to inorganic or organic arsenic compounds when they are given feed, forage or liquid contaminated with arsenical herbicides, rodenticides or insecticides. Chronic toxicity can occur when arsenical compounds are fed at low levels because the metal accumulates in the liver, kidney and bones.

**Mercury:** It has been most frequently associated with feeding to animal's seed grain treated with mercury containing dressings to prevent fungal growth.

**Cadmium:** In farm animals the greatest concentrations occur in kidney and liver. Kidney mal-function in man begins when the concentrations are above 200ug/g wet weight. Copper: The metal tends to be accumulated in liver and kidney. Other metals such as fluorine and selenium.

**Mycotoxins Residues in Meat:** Products of toxigenic moulds growing in meat and meat products. Aflatoxins are produced by *Aspergillus flavus* and *Aspergillus* parasiticus. There are four major types of toxin labeled AFB1, AFB2, AFG1 and AFG2. AFB1 is the most commonly produced and the most toxic. Liver, kidney and milk are considered to be the most vulnerable to residue accumulation. Ochratoxins are produced by some Penicillium spp. and some Aspergillus strains. Ochratoxin A is the most common and the most toxic to birds, mammals and fish. The kidney is the site for The presence of these toxins and they can be detected by a range of commercially–produced immunoassay KITS, and if positive animals are identified, they should be retained on a toxin-free diet for 4 weeks prior to slaughter to ensure that the levels in kidney have decreased [115-118].

## Conclusion

Meat is an important source of nutrition for people. Now days, it also gives livelihood opportunities for farm families, processor and other people who are directly or non-directly involved in meat or meat Products processing. Consumer, industry and governments need up-to-date information on how meat and meat products can contribute to human nutrition and meat processing industry development can best contribute to increasing food security and alleviating poverty.

## Conflicts of Interest

The author declare no conflicts of interest

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