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# IMPACT OF USE OF MECHANICALLY RECOVERED POULTRY MEAT ON QUALITY OF EMULSION TYPE SAUSAGE

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**For the Degree of Ph. D.**
**Hygiene and Control of Meat and its Products**

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**Title of the thesis:** Impact of use of mechanically recovered poultry meat on quality of emulsion type sausage

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## Abstract

(**Key words:** MRPM, Collagen, Calcium, TBARS, Shear force, Bone, Cartilage, Luncheon sausage)

Forty traditional Egyptian beef luncheon sausages were examined to determine their quality. Most luncheon sausage samples had bad sensory panel scores, low moisture, protein, magnesium, zinc and high ash, collagen, calcium, iron, cupper, manganese contents as well as high TBARS. Marketed sausage samples had higher aerobic and anaerobic bacterial counts as well as various types of pathogenic clostridia were isolated from them. Low shear force, high lightness, redness and brownness were characteristics for all marketed sausages. Most of the examined samples contained both bone and cartilage which could be detected either by phase contrast or light microscope. Six trials based experiments (with three replicates each) were performed to explore the effect of MRPM when added with different percentages (0, 10, 30, 50, 70 and 90%) to luncheon sausage formulations then cooked at different core temperatures (70, 80 and 90°C) on the quality attributes of luncheon sausage. Examination of both control luncheon sausage without addition of MRPM and those containing different rates of addition during storage at 4°C for 3 months indicated that both level of MRPM and storage time had a negative effect on their organoleptic and eating quality characteristics. Protein content of luncheon sausage was the most prominent constituent affected by addition of MRPM. Luncheon sausage formulated with high rate of MRPM addition characterized by high calcium, iron, copper, manganese and low zinc and magnesium content. Moreover, low shear force, high lightness, redness and brownness were noted in luncheon sausage formulations with a high percentage of MRPM addition. Different cooking core temperature had significantly changes in most criteria of sausages as well as on their different structures. Photos of histological staining with H&E and trichrome blue of experimental sausages with different addition rates of MRPM can be used as a safe method for quantitative determination of rate of addition of MRPM to sausages. Finally it is advisable to restrict the addition rate of MRPM to luncheon sausage to not more than 30% of the meat mass. Increasing the addition of MRPM to luncheon sausage as well as storage at 4C for 3 months adversely affected organoleptic and eating quality characteristics of such product.

# *Dedication*

*To my husband and my son EYAD*

*To my father and my Mother*

# ACKNOWLEDGMENT

First of all, my gratitude and prayerful to my ALLAH who gives me the power not only to carry out this work but also during my whole life.

I wish to express my sincere gratitude to ***Dr. Nada K. Mansour***, Professor of Meat hygiene, Head of Department of Food Hygiene and Control, Faculty of Veterinary Medicine, Cairo University, for his stimulating supervision, guidance, continuous help and interest during supervising this work.

My grateful appreciation and thanks are due to ***Dr. Mohamed T. Emara***, Professor of Meat Hygiene, Faculty of Veterinary Medicine, Cairo University for his continuous help, advice, guidance throughout this study.

It pleasure to acknowledge ***Dr. Gehan M.A. Kassem,*** Assistant Professor of Meat Hygiene, Faculty of Veterinary Medicine, Cairo University for continuous help, her guidance and support.

It is a great pleasure for me to thank ***Dr. Nabil Abdel-Gaber Yassien*** Professor of Meat Hygiene and Control, Director of the ***Regional Center for Safety and Quality of Foodstuffs***, Faculty of Veterinary Medicine, Cairo University for his continuous help and offering materials and equipment.

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# INTRODUCTION

Processed meats are increasingly becoming very expensive especially in developing countries due to the relatively high cost of meat used in its formulation. In order to provide a variety of processed meats at reasonable prices and satisfy all shades of consumer's desire for processed meats, use of alternative protein sources at lower costs should be encouraged. Huge amount of skin, frames and necks are produced worldwide as a result of massive increase in poultry production as well as changing consumers eating attitude from consumption of whole chicken to cuts and fillets. Mechanical recovery process provides the magic solution for utilization of these leftover materials **(Froning, 1981; Dawson et al., 1988)**, with production of Mechanically Recovered Poultry Meat "MRPM". The increasing availability of MRPM as well as its good nutritional and technological properties **(Serdaroğlu et al., 2005)** presented the meat industry with a potentially valuable raw material for use in emulsion-type meat products as frankfurters, various loaf products, fermented sausage and restructured chicken products **(Perlo et al., 2006)**.

Emulsion type sausages are widely used in the production of meat products such as bologna, frankfurter **(Dingman et al., 2002)** as well as different types of sausages in different countries e.g. traditional Egyptian luncheon. Meat emulsions are one of the most high price meat products because it depend mainly on high cost lean meat. Consequently most processors replace the expensive meat by cheaper materials such as MRPM **(Tyburcy et al., 2005).**

**EU Regulation 853/2004** defined mechanically recovered meat as a product obtained by removing meat from flesh-bearing bones after deboning or from poultry carcasses, using mechanical processing by crushing bone and adhering tissues then forcing the crushed tissues into the mechanical meat/bone separation equipment to remove connective tissue and bone particles. Crushing of the bones and subsequent mechanical separation leads to changes in the chemical, physical, sensory and functional properties of the meat **(Abdullah and Al-Najdawi, 2005)** including the development of undesirable aromas (rancidity), loss of its characteristic red color

because of lipid and pigments oxidation and loss or modification of the muscle fiber structure as well as reducing the stability during storage **(Mielnik et al., 2002; Bodner and Sieg, 2009).** Loss of quality can also resulted from the redistribution of the higher initial microbial load which favors the growth of microorganisms **(Gill, 1988).**

The recipe and process of emulsion sausages should be simple and adaptable to fairly wide variation in raw materials **(Ranken, 2000).** The recipes should be formulated to satisfy a variety of purposes, including legal/regulatory requirements, information for costing, quality control and consistent product standards. The main problem arise from use of MRPM in the meat products specially emulsion type products is the presence of the connective tissue, in which the main protein is collagen, which decreases water holding capacity "WHC" when heated at temperatures of 60-65ºC, causing shrinking, unstable emulsions, gel formations and wrinkling of the external skin of the emulsified products **(Trindade et al., 2004; Abdullah and Al-Najdawi, 2005; Ichinoseki et al., 2006; Tintchev, 2013).**

There are several questions about the safety of Mechanically Recovered Meat "MRM" as well as its aesthetic perception. Moreover, consumer's defense groups are concerned about the inclusion of bone fragments in MRM **(Froning, 1981)**, where mechanical separation results some bone particles (Ø<0.5 mm) remain in the meat mass**.** Therefore, many countries established regulations for use of MRM in poultry and meat industry **(EU Regulation, 2074/2005).**

Lack of legislations governing addition of MRPM to various meat products in Egypt encourages most of meat processors to use MRPM as an inexpensive material to substitute meat either partially or even totally in formulation of poultry and meat products **(Emara, 2005)** without care to its health hazards to consumer or its impact of product's quality and shelf life. Therefore, the present work was aimed to study:

A. Impact of addition of different rates of MRPM on different sensory, chemical, bacteriological as well as physicochemical quality attributes of the traditional Egyptian luncheon sausage
B. Effect of different cooking temperatures on quality of luncheon sausage

# LITERATURE

## Mechanically recovered poultry meat in meat products

**USDA (1994)** indicated that MRPM is combined with meat from other species e.g. beef and pork in formulation of various meat products e.g. frankfurter, bologna and patties as well as nuggets. MRPM is added in higher proportion into emulsified meat products than non-emulsified ones. The stability of meat mixtures from MRPM depend upon the type of raw materials, the protein and fat content, the time of operation in bowel cutter and the final batter temperature.

**Crosland et al. (1995)** claimed that MRPM is frequently used in the formulation of comminuted meat products as an alternative to meat due to its consistency and relatively low cost. It is, therefore, considered misleading to the consumer if products supposed to be made from whole muscle or piece of meat containing undeclared MRPM.

**Rivera et al. (2000)** found that meat recovered from bones in most countries was subjected to strict regulations concerning its use as a binding agent or as a source of meat in meat products.

**Stangierski and Kijowski (2000)** stated that MRPM is a meat-fat homogenate, with functional properties, chemical composition and shelf life that are considerably inferior to those of manually recovered meat.

**Benitez et al. (2002)** reported that MRPM is being used successfully in a wide variety of emulsified and other meat products e.g. frankfurters, various loaf products, fermented sausages, restructured chicken products, hamburger, patties, fresh and smoked sausages, and even to chunked and formed products.

**Stangierski and Kijowski (2003)** claimed that MRPM is a raw material with limited processing ability due to its lowered functionality, highly comminuted structure, and limited storage and microbiological stability.

**Tyburcy et al. (2005)** claimed that most processors replace high quality and expensive meat by lower quality and cheaper materials such as Mechanically Recovered Meat "MRM" from poultry and pork in production of frankfurter-type sausages.

**Perlo et al. (2006)** reported that the MRPM has the appearance of finely comminuted meat; thus it is used in a wide range of emulsified meat products as frankfurters and, in smaller proportions, in non-emulsified meat products such as fermented sausage and restructured chicken products.

**Tremlová et al. (2006)** claimed that MRM is a relatively non-standardized raw material which, despite its higher bone and calcium contents, has the structural characteristics of minced meat, and because of this it is easily incorporated into meat processing technologies.

**Püssa et al. (2009)** stated that the relatively low price of MRM may cause a temptation of adulteration of comminuted meat products with MRM. The addition of MRM to other meat products should be at least regulated probably as it enhance lipid oxidation.

**CEN (2010)** reported that the primitive pressing machine (using pressures of up to 200 bar) used to separate the meat from the bones yielded a fine textured meat paste suitable for use only in cooked sausages.

**Reig and Toldra (2010)** stated that lipid oxidation of Mechanically Separated Poultry Meat "MSPM" has an economic impact on the meat industry as it leads to the development of potentially toxic reaction products e.g. aldehydes, ketones, alkanes, etc. and chemical spoilage in the food system.

**Hrynets et al. (2011)** claimed that the main problem encountered with Mechanically Separated Turkey Meat ‘MSTM’ is due to its method of production, which includes grinding meat and bones together, and forcing the mixture through a perforated drum with consequent separation into two fractions, mechanically separated

meat and bone residue. This method of preparation causes the release of a considerable amount of fat and haem components from the bone marrow which becomes incorporated into the meat product.

**Tintchev (2013)** reported that MRPM is added mostly in emulsified meat products such as frankfurters and hotdogs. However, use of MRPM is limited in most European countries because of the low customer's acceptance as well as the short shelf life.

## Effect of MRPM on quality of emulsion type products

**Froning et al. (1971)** observed that Thiobarbituric acid value "TBA" of frankfurter formulated with 15% fresh Mechanically Recovered Turkey Meat "MRTM" was high due to the development of oxidative rancidity during frozen storage. However, no differences were reported in the microbial counts of frankfurters formulated with 0 and 15% fresh MRTM.

**Chant et al. (1977)** stated that rapid onset of oxidative stability with development of off-flavors and off-odors are the major problems commonly observed in the products manufactured with MRPM. Excess iron from marrow in MRM resulted in off-taste described as a “liver” taste. Experienced panel members preferred the products produced totally from meat because of the typical flavor of the product. Panelist could distinguish the specific flavor of MRM and grittiness in 30% MRM formulated products.

**Randall (1977)** observed that collagen and fat contents of MRPM is directly correlated with the skin content of the carcass before the separation process. Large amounts of collagenous connective tissue and fat adversely affect the emulsion stability of the poultry meat products. However, emulsion stability of MRPM is greatly affected by high fat content rather than the collagen content.

**Froning (1981)** found that salt soluble proteins and the emulsification capacity was lower in MRPM than in hand recovered meat and therefore, does not support a