

DEVELOPMENT OF SECTIONED AND FORMED MEAT PRODUCTS USING DEBONED MEATS

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ABSTRACT

This paper discusses the use of deboned meats. It discusses the four main methods of restructuring meats, the advantages of the technology, and the main problems encountered with this type of meat, including oxidation and excess connective tissue. It includes several flow charts for different types of production system.

INTRODUCTION

The use of deboned meat transforms the secondary parts of the carcass into products of higher value, which are reasonable in price and have the eating characteristics of solid muscle steaks and chops. The Urschel Lab first announced success in making restructured steak from deboned meat in the 1970s. A universal comminuting machine which had been used to slice flaked vegetables was used. The cost of the flaked and formed product was about half that of solid muscle products. At the same time, meat scientists at the University of Nebraska developed a flaked and formed pork steak under contract with the United States National pork Producers Council. Today, fast-food chains are offering a wide variety of restructured red meat, poultry, and seafood products throughout the world. Some examples are McDonald's Chicken McNuggets and Pork McRibs.

METHODS OF RESTRUCTURING MEATS

There are four main methods of restructuring meats: Flaking and forming;

chunking and forming; sectioning and forming; and a combination of these methods.

ADVANTAGES OF RESTRUCTURED MEATS

Increasing market value

The main reason for restructuring meat is to transform relatively low-value carcass parts into products with an increased market value. From the consumer side, consumers can buy products which closely resemble high-value meat products, but at a much lower price.

New Products

The restructuring process makes it possible to create various new products for different markets. In addition to the fabrication of steaks and chops, restructured meats can be formed into dice, sticks or nuggets, of practically any shape and size.

Better cost accounting

Each serving is alike. Accurate figures for the cost per serving can be predicted in advance.

Keywords: acceptance, chunking, color, connective tissue, cost accounting, deboned meat, flaking, formed meat, oxidation, sectioning

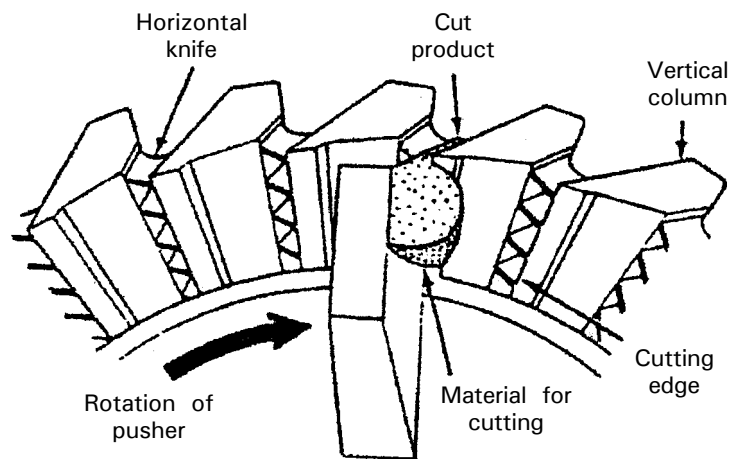


Fig. 1. Diagram depicting the inside of a Comitrol flaking head. The size and thickness of the flakes depends on the relationship between the vertical columns and the cutting edge of the horizontal knives. The material to be cut is pushed against the knives by the rotating pusher.

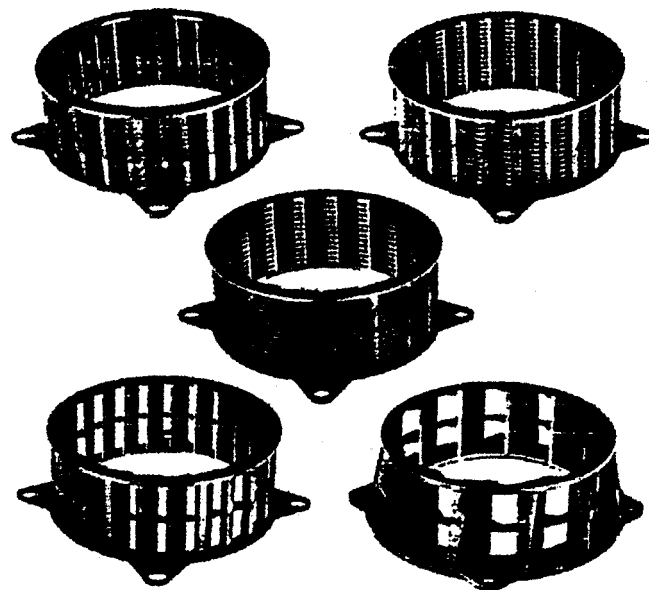


Fig. 2. Examples of flaking heads for Comitrol. The size of the head, the number of knives, and the spacing of the separators determine the size and shape of the cut flakes.

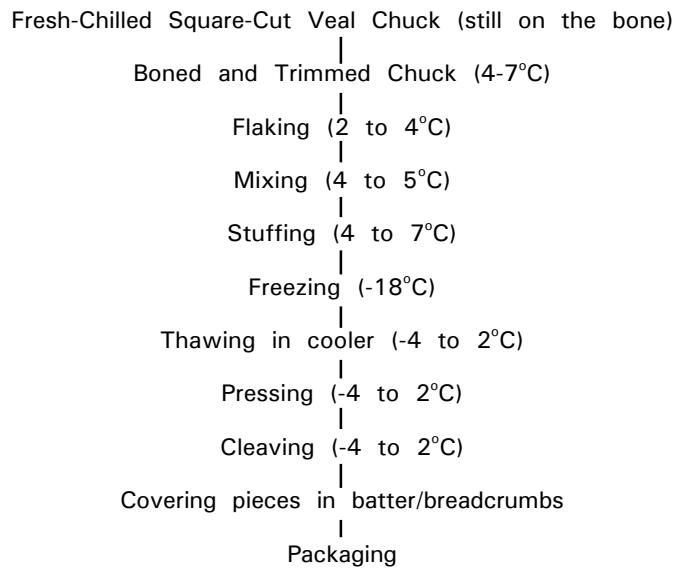


Fig. 3. Steps in the fabrication of flaked and formed veal steaks. Temperatures shown are the optimal ones for each process. Source: U.S. Army Natick R&D Center

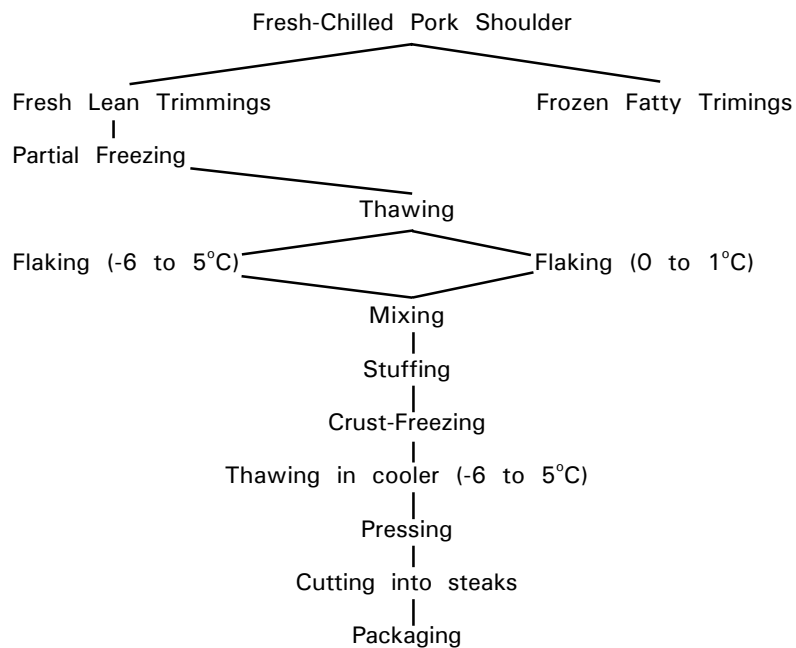


Fig. 4. Steps in processing flaked and formed pork steaks from lean and fatty trimmings. Temperatures shown are those considered optimal for each process. Source: Univ. of Nebraska

Table 1. Advantages and disadvantages of different types of restructured meat

| Properties | Flaked and formed | Chunked and formed | Sectioned and formed |
|---------------------------------------|-------------------|--------------------|----------------------|
| Advantages^a | | | |
| Easily formed into desired shape | xxx | xx | x |
| Raw materials are widely available | xxx | xx | x |
| Economical | xxx | xx | x |
| Nutritional content can be programmed | xxx | xx | - |
| Resembles solid muscle | x | xx | xxx |
| Problems^b | | | |
| Off-flavor | xxx | xx | x |
| Color variation | xxx | xx | - |
| Rancidity | xxx | xx | x |
| Connective tissue can be seen | x | xxx | xx |

ax = least advantageous; xxx = most advantageous.
 bx = least problematical; xxx = most problematical.

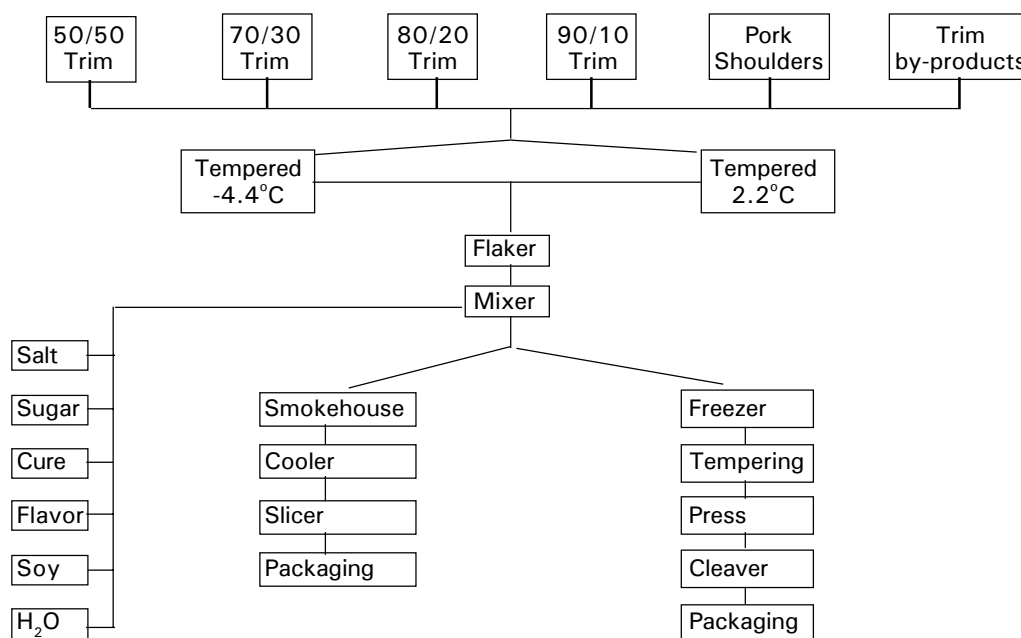


Fig. 5. Scheme used in a flaking production system.
 Source: Mandigo 1975

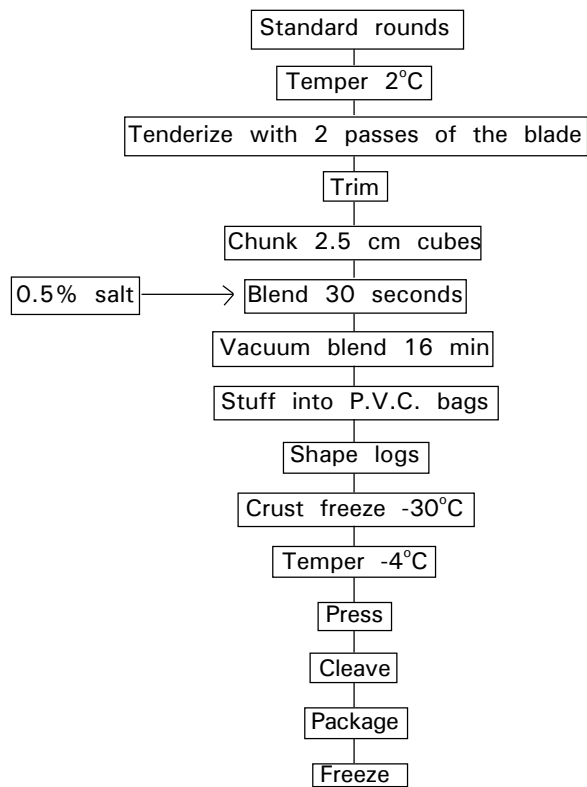


Fig. 6. Scheme used in a chunking production system.

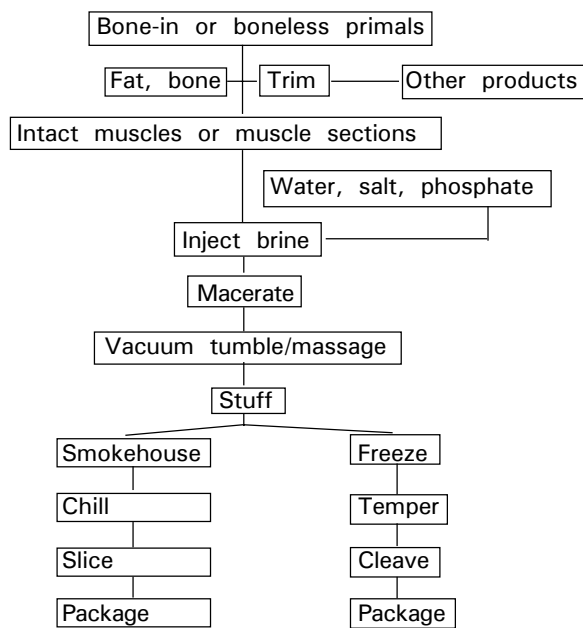


Fig. 7. Scheme used in a sectioning production system.

Accurate prediction of cooked yield and serving size

A chunk of sectioned and formed meat, cooked in an oven at a controlled temperature, provides the food service manager with a totally predictable cost per serving of meat, with almost no waste.

Programming for nutritive value

Flaked and chunked meats can be programmed as required for fat content and nutrient fortification.

PROBLEMS WITH RESTRUCTURED MEATS

Oxidation

Steaks are no longer made from flaked, chunked and formed meat by the processes first developed. This is because such steaks had rancidity problems. The use of carbon dioxide snow during the flaking process has prove beneficial.

Color problems

There may be variation in the color of restructured meats, with splotches of green and brown among the red.

Excess connective tissue

Connective tissue is probably the major concern to the producer of formed meats. It looks a different color (white and grey) and is often fibrous and chewy.

Problems in retail acceptance of restructured meats

Most flaked, chunked and formed products are designed to be retailed as a frozen product. Consumers and retailers may not find the fresh product acceptable.

MICROBIOLOGY OF RESTRUCTURED MEAT

No serious problems with pathogenic bacteria in restructured meats have been

reported. However, more information would be highly desirable about *Salmonella*, *Campylobacter jejuni*, *Staphylococcus aureus*, *Clostridium perfringens*, and *E. coli* O157:H7.

PREVENTING OXIDATION AND OFF-FLAVOR IN RESTRUCTURED MEAT PRODUCTS

Nitrites

Most reports have concluded that nitrites used in restructured products are effective in reducing oxidation.

Phosphates and other metal chelators

The mechanism by which phosphates and other metal chelators prevent oxidation in meat products appears to be related to their ability to sequester heavy metal ions.

Ascorbate and antioxidants

The used of ascorbate and antioxidants can keep restructured meat fresh for longer, and retard rancidity.

Smoking

Smoking meat and other foods not only gives them a desirable flavor and color, but also contributes substantially to preservation. It does this by acting as an effective antioxidant and antimicrobial agent.

PRODUCTION FACTORS AFFECTING BINDING

Salt and phosphates

Reports indicate that adding salt has a marked influence on the water-holding capacity of restructured meat, and also its shear force, raw and cooked texture, and juiciness.

Temperature

It is recommended that restructured meat be kept at or near the freezing point when it is being processed. This is so that the meat protein retains its maximum solubilization.

Transglutaminase

By adding transglutaminase, a bond is formed between the muscle protein side chains. This increases the gelling properties of muscle protein.

Gums

Different gums such as alginate and carrageenan combine with calcium ions. They have been shown to increase the binding properties of restructured pork products, and help them keep their shape.

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