HOT CUTTING AND PROCESSING OF PORK

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The processing of pork products to a finished form prior to initial chilling appears to have many advantages over the present techniques utilized in pork processing. Present industry methods require the products to remain in the packinghouse from two days to two weeks depending on the various steps in fabrication. Accelerated pork processing methods could be used to reduce to a minimum the costly fabrication steps involved with carcass chilling, curing, smoking, and final chilling found in conventional processing.

The completion of all or some of the fabrication steps prior to the initial chilling of the pork product has been described as "Hot Processing", "Pre-Chill Processing", "Processing Prior to Rigor Mortis", and "Accelerated Pork Processing". All are, in fact, attempts to accelerate the inplant processing steps and result in significant processing time reductions.

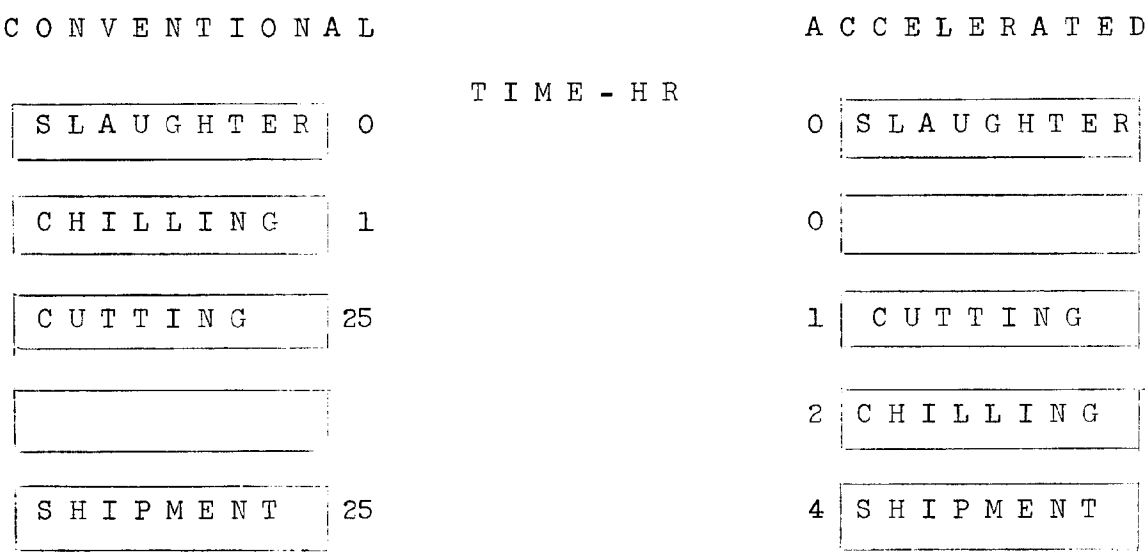
The flow chart for the fresh cuts is shown in figure 1. Slaughtering and preparation of the carcass for the cooler is not changed in the accelerated pork processing systems. These "new" systems start at the point where the carcass would normally leave the slaughter floor. The time elapsed from the completion of slaughter is shown for both the conventional and the accelerated processing systems. Chilling is omitted in the accelerated system. One hour of time is allowed to the point where effective chilling would take place. Thus 25 hr would have elapsed to the point where cutting of the carcass takes place in the conventional system as compared to one hour for the accelerated system. Chilling following cutting is omitted in the conventional system and requires approximately two hours in the case of fresh pork cuts in the accelerated system. Thus, the fresh pork products are ready for shipment in about 25 hours in the case of the conventional system and about four hours in the rapid system.

A similar figure (fig. 2) is shown to illustrate the flow pattern for the cured cuts. Again zero time is considered to be the point where the carcasses leave the slaughter floor. The chilling and cutting steps are the same as for the fresh cuts. Pumping of the cure is started at about 26 hours in the conventional cuts and two hours in the rapid system. Three days curing time was allowed for the conventional system, while one hour was allowed for the rapid system prior to placing the meat into the smokehouses. A smoking time of 10 hours was used for both systems. Chilling after smoking added 24 hours to the conventional, and two hours was used in the accelerated system. Thus, time elapse to earliest shipment was 132 hours for conventional processing and 15 hours for the accelerated methods. Many variations on these flow charts can be found; these serve only as examples.

The effect of the processing method on the yield and quality factors of ham was reported by Mandigo and Henrickson (1966). They found no significant differences in the yield of the finished ham. Lean, fat and bone components removed from the boneless, pressed hams were not found to be significantly different. Some difficulty in removal of the ham was indicated and the removal of fat was reported to be easier from hot-processed hams than from those processed cold.

Warner-Bratzler shear values were determined on 3/4-inch cores taken from 1/2-inch slices (Mandigo and Henrickson, 1966). The differences between hot- and cold-processed hams in tenderness were non-significant.

Fig. 1. Flow Diagram for Fresh Cuts

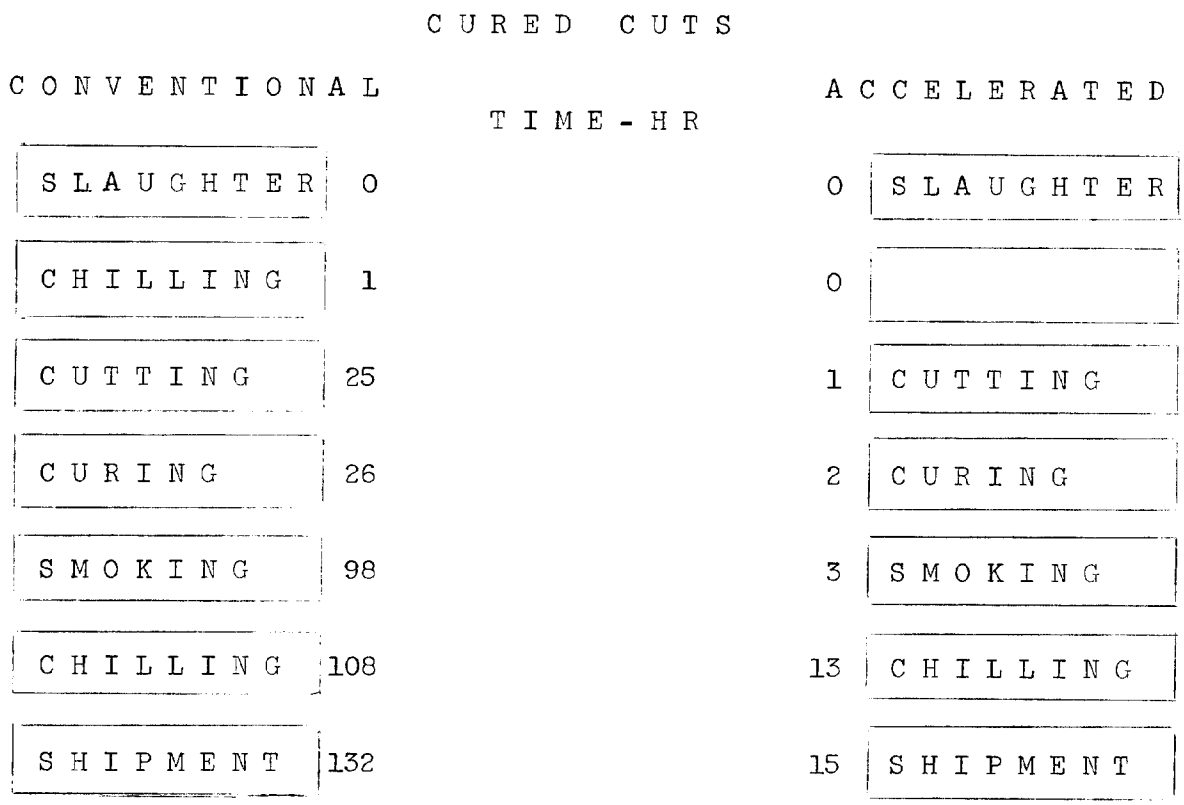


These findings are further supported by Davidson et al. (In Print) who found no significant difference in the shear values of semimembranosus and biceps femoris muscle from hot and conventional processed hams. Percent moisture of the ham samples was determined by the AOAC (1950) methods. No significant differences were found in moisture content (Mandigo and Henrickson, 1966). Davidson et al. (In Print) were unable to show differences in the expressible moisture ratios of cured and smoked semimembranosus and biceps femoris muscles from hot and conventionally processed hams.

Weiner (1964) found hams cut and processed within one hour of bleeding to have significantly lower drip losses, cooking losses than the controls. He found significantly lower shear values in the treated hams.

Davidson et al. (In Print) found no significant differences in processing weights, processing shrinkage weights, and percent shrink of cured and smoked hams from hot and conventionally processed carcasses. Weiner et al. (1966) reported no significant differences in curing yield between hams pumped within 1 hour post-mortem and control hams.

Fig. 2. Flow Diagram for Cured Cuts



An evaluation of the fresh pork loin processed by hot processing methods was reported by Moore et al. (1966). Four-inch sections were frozen from pork loins starting between the 10th and 11th ribs and extending posteriorly. Following freezing, the loins were thawed and thaw loss determined. The amount of thaw loss was found to be significant ($P < .01$) for variation among animals, but no significant differences were found between the methods of processing. Moisture loss, residual moisture, and shear values were determined. No significant differences for any of these measures were found for method of cutting (hot vs. cold processing).

Weiner et al. (1966) studied the effect of method of processing. Muscles from loins removed prior to rigor mortis and chilled were significantly more tender than controls, while loins removed and frozen had significantly higher shear values. Freezing temperatures were employed by Moore et al. (1966), but complete freezing did not occur, only a surface freezing. Under these conditions, no significant differences in shear value were observed.

Mandigo and Henrickson (In Print) reported the effect of processing method on bacon and indicated that method of processing had little effect on the yield of bacon. Significant differences in the length and width measurements were noted. Commercial pressing of the slabs reduced the differences but did not completely compensate for method of processing. The differences can be characterized by wider and

shorter slabs found for the pre-chill processed bacon. These differences were attributed to the stretching effect which normally occurs in the chilling of the intact carcass.

No significant difference was found in the number of slices obtained from the bacon processed hot or cold. The weight of sliced bacon, bacon trim and processing shrink were also found to be non-significantly different for the two processing treatments.

Barbe et al. (In Print) found the incidence of aerobic bacteria in rapid processed ham to be comparable to that in the conventionally processed product. Greater reduction in total bacteria numbers were obtained with the rapid processing technique. They found 68% of the hot processed hams with no colonies or insignificant numbers per gram as compared with 53% for the conventionally processed hams based on internal samples. Clostridia were isolated from the tissue of four hams out of the total 38 surveyed, all were negative for Clostridium perfringens. The level of contamination by anaerobic organisms was found to be less than 10 per gram of tissue.

Davidson et al. (In Print) reported higher mesophilic counts from hot processed pork sausage. They reported that their findings tend to agree with those reported by Pulliam and Kelly (1965) who worked with hams. Psychrophilic counts after 15-20 days in storage showed significantly greater counts. Coliform counts were erratic and generally low in their study, which is in agreement with the findings of Barbe et al. (In Print).

The moisture, protein, ether extract, ash and salt contents of sausage from hot and conventionally processed carcasses were not significantly different in the work by Davidson et al. (In Print). Iodine numbers were determined to measure the degree of unsaturation of the pork sausage. They found no differences attributable to method of processing. Significantly greater ($P < .01$) peroxide values were found in conventionally processed sausage after 10 and 20 days than in the sausage from hot processed carcasses.

Mandigo (1967) reported the results of a color stability study on boneless, fully-cooked, pressed hams. He found no significant difference in the amount of extractable nitroso-pigments when evaluated 24 hr after the completion of processing. Ground samples were exposed to 200 ft-c of fluorescent light for various periods of time (0, 30 min, 1, 2, 3, 4, 5, 6, and 24 hr). Significantly more nitroso-pigments remained after 30 min exposure to light in the case of the pre-chill processed ham. No significant differences were observed in the one through 24 hour exposures.

In all cases, the accelerated processed hams contained more nitroso-pigments. Nitroso-pigments were found to be 54 ppm at zero time and 5ppm at 24 hours.

Current status of work at the University of Nebraska involves design, development and testing of a prototype system to be evaluated under packinghouse conditions. Following testing and evaluation under

laboratory conditions, the system will be placed in a commercial packing plant and evaluated under their conditions with packinghouse personnel operating the system. Work in this phase is being supported under a Cooperative Agreement with the Transportation and Facilities Research Division of the USDA-ARS. Personnel from the Animal Science and Agricultural Engineering Departments at the University of Nebraska are involved in the current phase.

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