ADVANCED MEAT RECOVERY SYSTEMS

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Background

Advanced Meat Recovery Systems (AMRS) have been developed in an effort to simplify the deboning of meat. For the purpose of this paper deboning is the process whereby all or nearly all edible tissue is extracted from bone in meat processing operations. Historically, this was done by the skillful use of knives of various kinds. More recently, motorized knives and other cutting instruments have been introduced. These make deboning more efficient and more rapid. The hand-held devices, however, have been associated with repetitive motion disorders such as carpal tunnel syndrome. Moreover, such devices are less efficient and more contaminative than stationary machines that do not require human handling. The stationary machines of the 1960s were criticized because of what was considered a rather crude approach to deboning consisting of the grinding of the bones containing the meat. A later step extruded the bones and bone fragments by means of sieves and other mechanical devices. This process resulted in an inefficient separation of bone from meat, leaving behind a residue of bone fragments and bone constituents that was of doubtful acceptability. New machines that are generally referred to under the rubric of Advanced Meat Recovery Systems (AMRS) are greatly improved and produce a higher quality product.

Regulation of Mechanically Deboned Meat

Disagreements have characterized the regulated introduction of mechanical deboning in the United States. A predecessor agency of the Food Safety and Inspection Service (FSIS) initiated rule-making in the use of the process in poultry in 1969. This was never finalized, leaving these uses of mechanical separation in a sense un-regulated. A regulation was finalized for red meat in 1982, but the labeling requirements included what were in effect warnings about bone and calcium content. This discouraged the use of the product. These initiatives have attracted the attention of consumer advocacy organizations. With red meat, there has been much hyperbole over the presence of calcium, bone marrow and nervous tissue in amounts larger than is present in non-AMRS meat.

At times public health concerns have been raised--usually indirectly--but there is no public health issue. In late April of 1997, the Administrator of FSIS wrote, "It is our belief, based on all of the currently available scientific information, that meat product derived from AMRS is safe and wholesome."

The issue regarding calcium is essentially that the levels in AMRS meat are higher than in non-AMRS meat. There is not the supposition that these levels are in any way deleterious. In fact the American diet, particularly that of young women, is only marginally sufficient in calcium. Therefore the added calcium is a good thing, but the levels are at variance with what is found in non-AMRS meat. This then becomes not an issue of safety but one of identity. Since the additional calcium comes from bone, other osseous materials and reduced collagen, some believe that the extra calcium represents either bad technique or a possible hazard due to potential bone chips. In point of fact AMRS represents improved technique and has all but eliminated the presence of bone chips when compared to other ground meats.

Reservations about the presence of higher levels of marrow are manifold but only indirectly related to public health. The presence of additional marrow increases fat, cholesterol and iron. Two of these substances, fat and cholesterol, are generally considered to be unneeded supplements to a meat product. Additional iron is useful in the prevention of anemia. The additional levels, nonetheless, do not rise to those found in organ meats. For example, 100 grams of beef liver contains approximately 6 mg of iron per 100 gms, 6 gms of fat, and 400 mg of cholesterol; pork liver contains from 18-23 mg iron/ 100 gms. All these values are in excess of typical analyses of AMRS meat. Thus, AMRS meat typically exhibits a superior nutritional profile.

The concern about spinal cord being present in AMRS meat relates to fears about bovine spongiform encephalopathy (BSE) or mad cow disease. This is based on experimental work that has shown the most infectious tissue in BSE cases is central nervous system tissue such as brain and spinal cord. Thus, the unexpected presence of nervous tissue in meats of any kind should be avoided. Presumably consumers of brains and other nervous tissue appreciate the potential infectivity of the substance and are willing to take the risk. BSE does not exist in the United States although it has been found in virtually every other western country at some point including Canada. More importantly, central nervous system tissue is not allowed in AMRS meat. FSIS issued a directive (7160.2) in 1997 declaring that product that contains spinal cord does not come within the definition of "meat." Moreover, the spinal cord must be removed from neck and/or back bones (if any) before bones enter the system.

Benefits

The efficacy of slaughter operations is generally gauged by the percentage yield of meat from the carcass. And although primal cuts are more valuable, it is essential that all edible tissue be harvested thoroughly. AMRS is the most efficient of currently available methods. Virtually since time began the challenge of meat production has been the efficiency of this gleaning process. The last portion of meat that is tenaciously adherent to the skeletal structure of the carcass not only represents an element of profitability, but is a product of nutritional versatility that has been a staple of most national cuisines for centuries--in the form of soups, bouillon, flavorings, stocks, processed meat ingredients, and many others.

Tertiary deboning will continue either by hand deboning or by machinery; the point is to determine what form and what system represents the most useful technology. The answer to this question is clearly AMRS. These systems are designed to take advantage of the knowledge that manually trimmed bones still retain as much as 30% meat to bone weight. Typical systems consist of presizers, machine separators and belt separators. The presizer reduces bones to a uniform length. The machine separator generally may be described as comprising a conical head-counterram system that peels the meat off the bones. The belt separator removes any residual bone and significant quantities of ligament, tendon and collagen that may remain with the meat portion through a system of belts and drums. The efficiency of AMRS systems therefore not only adds nutritive precursors to processed foods, but also makes meat processing operations more efficient and more profitable. The price of any cut of meat or any other component of an individual carcass is directly proportional to the efficiency of the meat recovery system. The fact that meat in the US costs less per unit than in most other developed countries is due to a constellation of factors, not least of which is the effectiveness of the meat recovery system.

An additional benefit of AMRS is the reduction in worker related injuries. Manual deboning and the use of motorized knives are dangerous, not only because of direct injuries, but because they are associated with repetitive motion injuries. Workers in the deboning areas of meat plants have an increased likelihood of developing carpal tunnel syndrome and other cumulative trauma disorders. Some studies have demonstrated a 38% increase in the probability of developing cumulative trauma disorder as a consequence of working in deboning operations. From a societal standpoint, this is perhaps the greatest advantage of AMRS.

Discussion

On April 13, 1998, FSIS published in the Federal Register a document entitled Proposed Rule on Meat Produced by Advanced Meat/Bone Separation Machinery and Recovery Systems. The stated rationale for the proposed regulation was that AMRS was not fulfilling expectations.

The basis for FSIS's conclusion was that the 1994 Final Rule on the same subject needed revision in order to fulfill its objectives. The stated reason for the promulgation of the 1998 Proposed Rule was to remedy the faults of the 1994 Rule. The cited faults were potential rather than actual. Sifting through the somewhat stilted language of the latter publication, the rationale seems to be that the 1994 rule focused on the physical condition of the bones rather than on the characteristics of the food product. While this may make logical sense, it in no way justifies why a rule is needed. In the absence of compelling public health concerns, the rule seems unnecessary.

In addressing the need to revise the 1994 rule, FSIS expressly stated in the proposed rule that these steps were being proposed not on the basis of food safety or of public health. An analysis of the preambulatory comments in the 1998 proposed rule shows clearly that the purpose of the new rule would be esthetics and a shift in emphasis to the final product as opposed to the deboning process. Esthetics here could include the presence of bone in food. The more dominant esthetic consideration is obviously with some of the by-products of meat recovery such as increased calcium and bone marrow.

In the case of calcium, the Agency wishes to lower the allowable level in recovered meat from 150 mg per 100 gms of product to 130 mg per 100 gms. This expressly was prompted by the realization that the calcium level is a remnant of meat recovery and may be an index of the efficiency of such systems. This latter supposition (the efficiency index) is premised on the knowledge that the origin of the calcium is the bone involved in the deboning process. Since it is known that many consumers do not achieve the recommended dietary level of calcium, it is questionable that FSIS would expend this much energy and resources on reducing the allowable level by 20 mg. It is at the same time understandable that there should be a tolerance for calcium. Large variances would not necessarily be in the public interest. This seems to be a manifest case of over-regulation with no real public benefit. In fact there could be public detriment to a sizable proportion of the population.

The second major correction anticipated as a result of enactment of the proposed rule is better control of the marrow content of deboned meat. The Agency details in

the proposal an ingenious calculus that equates the iron content of the finished product with the level of marrow. Reference also is made to the potential for using pH and/or hematopoietic cell concentration. It is necessary to utilize an indirect measurement because the amount of fat added by marrow apparently falls within the normally expected range. The reason marrow is singled out for consideration is apparently because this is a constituent not normally expected in meat. It is important to note that one of the constituents of marrow, immature erythrocytes, can be found in the general circulation and therefore in the meat of animals undergoing physiological stress. The allowable level that is being proposed is "excess iron" 1.8 mg/100 gms of finished product. An equivalent amount of calves liver would contain approximately 14 mg. Iron deficiency is a problem in some subpopulations, but not to the extent calcium is. The advantage of iron sources from livestock or fish is that such iron is well absorbed, whilst the iron in vegetables, nuts, seeds and fruits is less well absorbed. It is well to set an allowable limit but the presence of iron in recovered meat should not be considered undesirable.

More importantly, allowing an upper limit of calcium to be 130 mg % or 150 mg % is disconsonant with an iron limitation of 1.8 mg extra iron per 100mg. AMRS, as the method of choice for separating meat from bone, produces a standardized product that naturally contains approximately 130-150 mg % calcium and 4-6 mg % iron.

Research has recently shown that nearly 40% of Americans are not meeting their needs for iron. Moreover, the heme iron present in meats is well absorbed from the gut while the non-heme iron from plants is absorbed only one-fifth as well.

Finally, the agency is concerned about the presence of spinal cord in recovered meat, but this concern has been previously dealt with through the issuance of two directives on the subject. Spinal cord is not allowed in meat. Specifically, spinal cord must be removed from the carcass before bones are subjected to AMRS. This procedure is expressly monitored by FSIS inspectors in the plant.

Conclusions

AMRS represents a highly sophisticated technology that is a marked improvement over previous mechanized and manual deboning procedures. AMRS is more efficient, and the product thereof is less likely to contain aberrant tissue than recovered meat from previous systems. The technology also reduces repetitive motion disorders as well as direct injuries such as cuts nd abrasions in meat plant employees. Finally, the technology results in more and higher quality recovered meat than previous automated systems or motorized knives could provide. Therefore, FSIS should, within limits, embrace the system and encourage its use.

In the final analysis, this is admittedly an economic issue and should therefore be market-driven. There are no microbiological or other food safety concerns. The nutritional issues as defined in the 1994 AMRS regulation are only favorable and certainly present no risk to consumers.

Attempts to refine the 1994 regulation at this point are unwarranted. None of the issues discussed in the 1998 Proposed Rule rise to the level of genuine concern. Therefore, rule-making is not indicated.

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Attribution

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