Advances in the control of Trichinella spiralis

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Communications

Food scientists are presently communicating with parasitologists and both groups are communicating with the industry, regulatory agencies and the consumer to develop improved methods for the detection and control of Trichinella spiralis. The number of scientific publications on T. spiralis in the United States has increased substantially in the last five years and Symposia entitled "Control of Trichinella spiralis in meat" and "Foodborne parasites of man : Their threat to the public health", were held at annual meetings of the Institute of Food Technology in 1982 and 1984, respectively. These symposia provided not only a forum for scientific debate but also enriched the literature with a summary of the "state of the art" concerning the importance of Trichinella spiralis and its control. In 1983, a book "Trichinella and Trichinosis", which was edited by W.C. Campbell, was published. A new book "Advances in Meat Science" has just been written and should be released in 1985. Chapter 2, "Parasitic Organisms", will provide the scientific community with the current results of research on a number of parasites, in addition to information of life cycles and epidemiology of the organisms (Murrell et al. 1985).

The National Pork Producers Council formed a Trichinae-Safe Pork Task force in 1982 and is encouraging implementation of methods for the control and elimination of Trichinella spiralis in pork. These methods include the enzyme-linked immunoassay (ELISA), and the pooled digestion technique for detection; irradiation, cold or heat for destruction of encysted larvae; and education of the consumer and the pork producer. They have established the year 1987 as a target for the elimination of that parasite from pork in the United States (Dudley, 1982; Anon., 1983). The trichinoscope method is not being considered for use because its accuracy is estimated at 50 percent (Miller, 1985). The National Live Stock and Meat Board is cooperating with the other segments of industry and has funded research at the Gerling Laboratory in California to develop procedures for cooking pork to a uniform internal temperature in microwave ovens. They have also funded the Iowa State University to evaluate the effectiveness of the cooking procedures recommended by the Gerling Laboratory for the destruction of T. spiralis during microwave cooking. The American Meat Institute has indicated that some of their members, representing the meat packing industry, are prepared to cooperate in the field testing of promising techniques for the detection of Trichinella spiralis.

Research

Epidemiological studies are underway by scientists in the Agricultural Research Service (Murrell, 1984) that will establish the current incidence of T. spiralis in swine, and will help to characterize the mode of infection of the animals. These studies include defining the role of rats in the transmission of trichinellosis and the development of regional surveillance programs based on new serological testing procedures. Research has been carried out succesfully to develop a rapid ELISA procedure which will be used to identify infected swine by sampling their blood ante or postmortem (Leighty, 1982, 1985). Scientists in Dr. Murrell's laboratory have recently used monoclonal antibody technology to purify the secretory antigen for use in a test which is 95 % effective in detecting T. spiralis in swine (Anon., 1984).

Scientists in Dr. Leighty's laboratory, who began pioneer work on the development of an immunoassay for this purpose in 1971, have field tested their immunochemical procedure for detecting T. spiralis in swine. Their assay can be completed in 25 minutes, is highly sensitive and specific and can examine large numbers of whole blood samples in a relatively short time. This immunochemical procedure has been reviewed by an international panel of experts who concluded that the "data are scientifically sound and it clearly demonstrates that this assay is capable of yielding reliable, reproducible results within and among competent laboratories". The use of the ELISA by certified laboratories has been authorized.

Research for control of T. spiralis infection of swine through vaccination is underway by Dr. D.K. Murrell of the USDA and Dr. R. Rapic, Zagreb, Yugoslavia. Vaccines will be prepared using live irradiation attenuated larvae and larval excretory-secretory products (Murrell, 1984). The vaccination program, when successful, can be utilized in the specific areas of the country where swine trichinosis may be localized.

Research to ensure destruction of T. spiralis in cooked and uncooked meat by heat, cold and control of water activity is also continuing. The influence of various cooking methods on the destruction of T. spiralis in fresh pork was described by Kotula, 1982; Kotula et al., 1982, 1983; Zimmermann and Beach, 1982; Zimmermann, 1983. A thermal death curve describing the cooking temperature and time necessary to destroy the larvae was reported by Kotula et al. 1983. The USDA regulations (1960) provide refrigeration temperatures and holding times needed to inactivate the larvae in the temperature range of -15 to -28,9°C. Further research on the influence of temperatures between -17,8 and -6,7°C is being conducted at the Iowa State University. Murrell (USDA) is presently studying the resistance of sylvatic strains of T. spiralis to freezing temperatures. Brake et al. (1984) reported that 10 to 30 Krads were needed to eliminate the infectivity of the larvae. The Food and Drug Administration recently approved the irradiation of pork using up to 100 Krads for the destruction of trichinae (Anonymous, 1985). Terrell et al. (1982) and Childers et al. (1982) reported research on the influence of salts and nitrites on T. spiralis larvae in pork sausage. Lotzsch and Associates (1974, 1977) published a series of research articles describing the use of water activity as an index of the destruction of T. spiralis larvae in hams and sausage meat products. It is anticipated that the results of these research efforts will lead to improved and more cost effective procedures for the inactivation of trichinae in pork.

Regulations

The Food Safety and Inspection Service (FSIS) of the U.S. Department of Agriculture routinely evaluates its regulations and revises them as necessary. To aid the industry in the detection and control of T. spiralis, the Department has amended the Federal meat inspection regulations to permit additional treatment methods for the destruction of T. spiralis in pork products (FSIS, 1985). The amendment expands the range of freezing and heating times for internal product temperature and prescribes drying times for sausages based on sausage diameter, salt content and temperature above 21°C. The drying times for hams and pork shoulders are based on smoking and drying at a range of room temperatures (FSIS, 1983). The FSIS plans to publish a "Procedural outline for verifying the lethality of a process treatment to trichinae" so that competent scientists can carry out additional evaluations for new or modified processes to determine whether such processes destroy the infectivity of the larvae. FSIS now permits use of a "Pooled sample artificial digestion method" which, when carried out by a certified laboratory, will exempt pork carcasses found to be free of T. spiralis from prescribed trichina destruction methods.

Conclusions

In the last five years, the research effort associated with Trichinella spiralis, has expanded significantly. The incidence of this parasite in swine, as well as its epidemiology in the United States, are being defined. The feasibility of vaccination of suspect hogs is being studied, and acceptable methods for detection include the ELISA and the pooled digestion techniques. The effectiveness of the destruction of the larvae by freezing, cooking and irradiation are being characterized more precisely. The mechanisms are now in place for the control of Trichinella spiralis in the United States. The scientific community can now be challenged with the need to develop detection and control measures for other parasites like Toxoplasma gondii.

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