Press Release  
final project report

Project No. QJ1210113 “The effect of traditional and non-traditional methods of processing meat from farm and wild animals on the incidence of emerging foodborne viral, bacterial and parasitic agents in end products.”

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The project was focused on the still topical issue of foodborne infections caused by pathogenic agents which have not yet been sufficiently investigated and have not been monitored by legislation. Meat and meat products can become sources of these pathogens. Methods of detection of selected agents have been introduced to our laboratory and used for the examination of samples taken from domestic and wild animals. These include domestic pigs, wild boar, sheep, goats, wild ruminants and game birds. Samples of raw materials, semi-finished and finished products, environmental swabs from the processing and sales environments and the hands of handlers were also examined in order to assess the extent of potential sources and pathways of meat and meat product contamination with the monitored pathogens.

During the study of zoonotic hepatitis E virus (HEV) it was found that its prevalence in pigs from organic herds (9.6%) and pigs from conventional herds (8.2%) in the Czech Republic is comparable. HEV was also detected in free living wild animals and in animals living in game preserves with the highest incidence being observed in wild boars and cervids. Recently,
HEV was for the first time detected in mouflons. Based on the similarity between the isolates, the virus was found to circulate between animal and human populations in the Czech Republic. The detection of HEV in retailed meat products pointed to the risk of transmission of this zoonotic virus via products containing pork. The detection of human norovirus (NoV), the most common causative agent of nonbacterial gastroenteritis, in the processing and sales environments, including handlers’ hands, showed that infected persons who shed viral particles can become sources of contamination of instruments and equipment. By these means, meat products can become directly or indirectly contaminated. These facts were confirmed by NoV identification in meat products intended for direct consumption and raw meat products.

Potentially pathogenic mycobacteria, particularly *M. avium* species, were detected both in the tissues of animals, even of those without clinical signs of disease, and in various types of meat products. The role of *M. avium* subsp. *paratuberculosis* (MAP) in the development of a number of chronic human diseases (e.g. Crohn’s disease) is often discussed.

In the Czech Republic, the seroprevalence of enteropathogenic *Yersinia* was found to be higher in domestic pigs and wild boars being reared in different production systems (organic 83.6%, conventional 81.1%; hunting 65.9%; animals kept for personal purposes 44.8%) compared with other European countries. The results showed a significant correlation between the presence of antibodies and the type of farming. The presence of the most common causative agent of human yersiniosis *Yersinia enterocolitica* (YE) in retailed raw meat products indicates that there is always a risk associated with their consumption when heat treatment is insufficient and they can become a potential source of cross-contamination during food processing. The detected biotype 4 and serotypes O:3 and O:9 are most frequently detected also in cases of human yersiniosis in Europe. The phenotypic characterization of isolates was supplemented with antibiotic resistance determination.
Results of a study aimed at the prevalence of *Toxoplasma gondii* (TG) in domestic pigs and wild boars from different farming systems in the Czech Republic showed that the risk of this most prevalent zoonotic parasitic disease was higher in animals from organic breeding systems (seroprevalence of 18.8%), in pigs kept for private interests (27.6%) and wild boars (15.4%) in comparison with animals kept under conventional conditions (3.3%). The detected genotype II is the predominant TG genotype in farm animals and is most frequently associated with human infections in Europe. Toxoplasmosis was studied in sheep and goats as these are species susceptible to TG infection which has serious effects on their reproduction. Products from these animals may also become sources of TG for humans as confirmed by the detection of TG DNA in tissues of lambs (16.7%) and kids (10.3%), and in raw goat’s milk (6%). The prevalence of TG was also assessed in wild ruminants (24.4%), the common pheasant (3.3%) and wild ducks (5.9%). Not only the consumption of undercooked or otherwise insufficiently processed game animals, but also the handling of infected animals and contaminated meat and organs can become potential sources of human infection.

Regarding the influence of the processing technology on products which are not heat-treated (NHT) and durable fermented meat products (FMP), it follows from our study that these production methods do not destroy viral agents. Considering the fact that infective doses are generally low, these products can pose a threat to consumers. The NHT process does not affect the survival of MAP which is a potential zoonotic agent and tissues of infected animals may be a possible route of human infection. On the other hand, the FMP production process with the use of starter cultures induced a significant decrease in MAP, and no live MAP were detected in the finished product.

The project outcome was a diagnostic tool for the detection of hepatitis A virus (HAV) by real-time reverse transcription PCR using external control analysis. The methodology is intended for the detection and quantification of HAV in various types of matrices (water, food, swabs, clinical
The users can employ the method for the virus detection and viral load determination and for the identification of possible ways of cross-contamination during the processing procedures. The methodology will also become part of the accredited methods in the Laboratory of Food Virology (VRI, Brno). The applied certified methodology No. 44 “Detection and quantification of *Toxoplasma gondii* by real time PCR in tissue samples” offers a standardized procedure for detecting the presence of the parasite or its nucleic acid in animal tissues, raw materials and foodstuffs of animal origin. It is a useful tool for the identification of infected animals under different farming conditions with subsequent selection of appropriate preventive measures. We will offer consultations to the end-users of our research outcomes, regarding their introduction into routine laboratory practices. They will also have an opportunity to carry out the examinations by means of our developed methodologies at the VRI laboratories with subsequent interpretation of results obtained and consultation about their further use.

Experts in the field, farmers, meat processors and eventually also consumers have been informed about the project outcomes through publications and presentations at conferences and workshops. The research results are also used for teaching undergraduate and postgraduate students involved in the programme of food safety, hygiene and food production technology. The project’s design has contributed to the acquisition and dissemination of new knowledge. This has attracted the interest of professional bodies in causative agents of foodborne illnesses which are not monitored under current legislation. The adoption of preventive and other measures based on the knowledge gained during this project’s implementation is a prerequisite for a significant reduction of the risk of infection via these pathogens through meat, meat products and other foods.