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# Assessment of potential contribution of official meat inspection and abattoir process hygiene to biological safety assurance of final beef and pork carcasses

Bojan Blagojevic*, Dragan Antic

*University of Novi Sad, Faculty of Agriculture, Department of Veterinary Medicine, Trg D. Obradovica 8, 21000 Novi Sad, Serbia*

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ABSTRACT

The performances of current official meat inspection and abattoir process hygiene in assuring biological safety of final beef and pork carcasses were assessed through risk ranking of zoonotic hazards associated with cattle and pigs that each of these risk management strategies can control. Among hazards associated with cattle, *Taenia saginata cysticercus,* nontyphoidal *Salmonella enterica,* verotoxigenic *Escherichia coli* and prion causing bovine spongiform encephalopathy were found as posing medium risk for public health whilst all others were found as posing low or negligible risk. Among hazards associated with pigs, *Trichinella*, *Toxoplasma gondii* in outdoor pigs and *Yersinia enterocolitica* were found as posing medium risk and *S. enterica* was found as posing high risk for public health, whilst all others as posing low or negligible risk. Analysis of the current two main risk management strategies in cattle and pigs abattoirs indicated that abattoir process hygiene has a higher public health protection potential than official meat inspection. Nevertheless, each of these strategies currently plays an important role in controlling some meat safety hazards that cannot be controlled by the other, so both have to be applied simultaneously.


## 1. Introduction

The safety of meat can be jeopardized by many biological, chemical and physical hazards; however, it is generally accepted that the biological hazards pose the highest food-borne risk for meat consumers (Norrung & Buncic, 2008; Pointon et al., 2006) – substantially due to their effect in the relatively short term (Lawley, Curtis, & Davis, 2008). These biological hazards are mainly zoonotic – originating from animals for slaughter – and can be clustered into two main groups: a) the hazards that *can* cause macroscopically visible lesions in animals for slaughter, and b) the hazards that *usually* do not cause macroscopically visible changes/lesions in slaughtered animals but are often present in the alimentary tract and/or on the hide/skin. Hazards (i.e. related changes/lesions) in the first group can be detected by the current official *ante-* and *post-mortem* meat inspection (EC, 2004) and removed from the meat chain. Hazards from the second group can be excreted by any animal (clinically healthy or diseased) and, even if causing lesions in slaughtering animals, these are normally not detected by the current meat inspection. The latter group of hazards can be detected only through additional, laboratory testing; however, this testing of samples from each carcass to multiple hazards is not practical, nor is reliable in terms of guarantees of the absence of hazards from all parts of slaughtered animals (Buncic, 2006, Chap. 6). Therefore, control of these hazards in abattoirs is based on prevention/reduction of their transfer from skin/guts to meat – i.e. abattoir process hygiene (FAO, 2004; Blagojevic, Antic, Ducic, & Buncic, 2011a).

Food safety risk analysis is used to assess the risks to public health from food-borne hazards, identify and implement appropriate risk management measures to reduce those risks and to communicate with stakeholders about the risks and measures applied (FAO/WHO, 2007). Risk management process – selection and implementation of measures for public health risk reduction to acceptable level – shall take into account the results of risk assessment (FAO/WHO, 2006). Given the potentially high resource costs associated with conducting risk assessments and/or implementing risk management decisions, risk ranking (as a preliminary risk management activity) has been recognized as the proper starting point for risk-based priority setting and resource allocation (EFSA, 2012a).

The effectiveness and appropriateness of the risk management options need to be reviewed regularly with an aim of continual improvement in public health (CAC, 2007). Today, the two main

* Corresponding author. Tel.: +381 21 4853350; fax: +381 21 6350419.
*E-mail address:* blagojevic.bojan@yahoo.com (B. Blagojevic).

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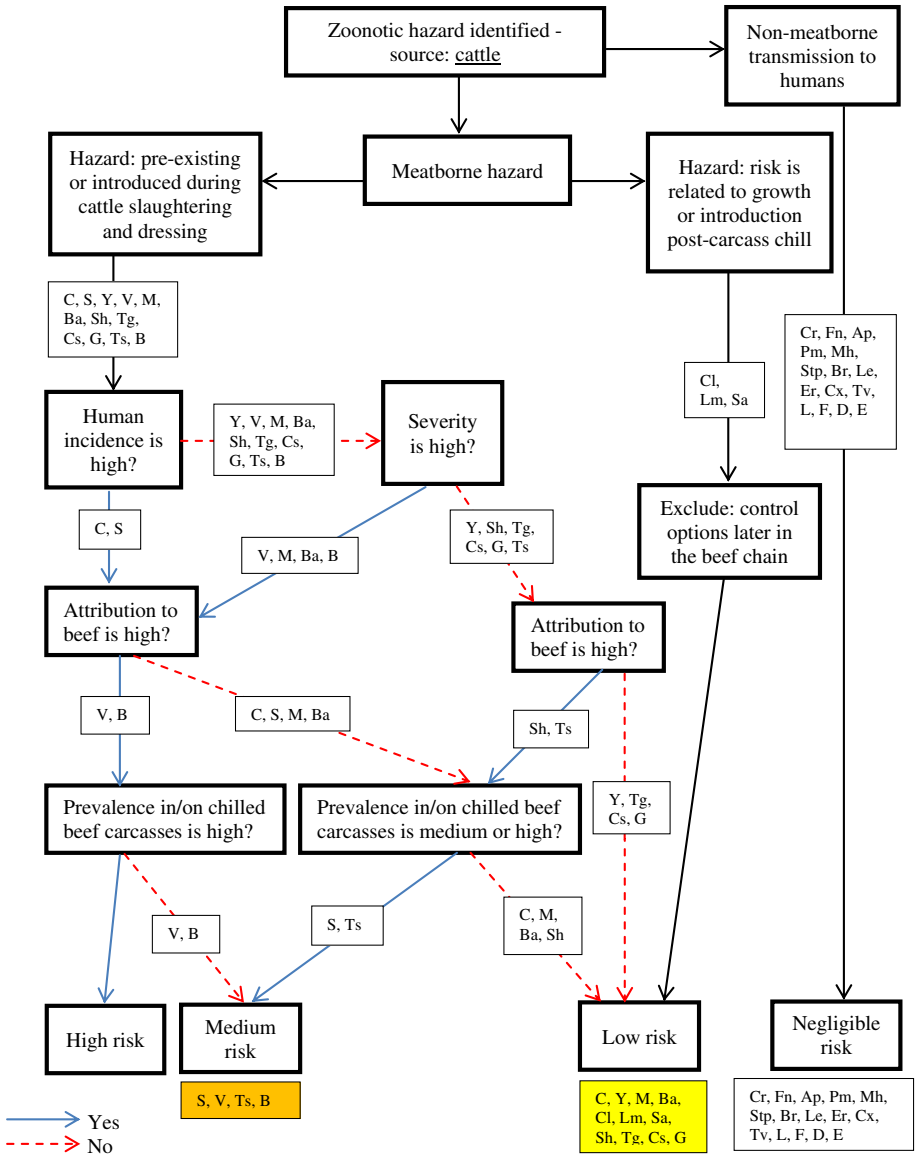


**Fig. 1.** Risk scoring of hazards associated with cattle. C – *Campylobacter* spp.; S – *Salmonella enterica*; Y – *Yersinia enterocolitica*; V – VTEC; M – *Mycobacterium* spp.; Ba – *Bacillus anthracis*; Cl – *Clostridium* spp.; Lm – *Listeria monocytogenes*; Sa – *Staphylococcus aureus*; Sh – *Sarcocystis hominis*; Tg – *Toxoplasma gondii*; Cs – *Cryptosporidium parvum*; G – *Giardia intestinalis*; Ts – *Taenia saginata cysticercus*; B – BSE-prion; Cr – *Corynebacterium* spp.; Fn – *Fusobacterium necrophorum*; Ap – *Arcanobacterium pyogenes*; Pm – *Pasteurella multocida*; Mh – *Mannheimia haemolitica*; Stp – *Streptococcus* spp.; Br – *Brucella* spp.; Le – *Leptospira* spp.; Er – *Erysipelothrix rhusiopathiae*; Cx – *Coxiella burnetii*; Tv – *Trichophyton verrucosum*; L – *Lyssavirus*; F – *Fasciola hepatica*; D – *Dicrocoelium dendriticum*; E – *Echinococcus granulosus*.

strategies in abattoirs for control of human meatborne risks are official meat inspection and process hygiene. The main objective of this study was to assess performances of these two risk management options in ensuring the overall biological safety of meat for meat consumers – through qualitative risk ranking of meatborne hazards in/on final beef and pork carcases that can be controlled by each of them.

## 2. Material and methods

### 2.1. Hazard identification

Hazard identification was based on literature review. To be included, hazards had to meet the following criteria: to be biological, zoonotic and associated with cattle/pigs. Furthermore, identified hazards were divided on meatborne (there was at least one example that the hazard caused disease through consumption of meat) and non-meatborne (not proven to cause meatborne disease).

### 2.2. Risk ranking

A qualitative risk ranking of identified meatborne hazards was conducted using modified decision tree developed by the European Food Safety Authority (EFSA) for ranking of the public health hazards associated with poultry (EFSA, 2012b, Figs. 1 and 2). Risks for public health due to the identified zoonotic meatborne hazards were assessed qualitatively (high, medium or low) at the point of chilled carcasses at abattoirs as a proxy for meat consumers' exposure, assuming that all stages of the meat chain from carcass chilling to consumers remain unchanged. Identified zoonotic hazards that are not proven to cause meatborne disease were excluded from ranking (risks are considered negligible in the context of this paper). Model variables in risk ranking (shown in Tables 5 and 6)