OCCURRENCE OF LISTERIA MONOCYTOGENES IN SELECTED FOOD OF ANIMAL ORIGIN

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Abstract

The present study was undertaken to determine the prevalence of *Listeria monocytogenes* in selected raw materials and food products of animal origin in Poland. In total, 1118 fish and fish products, and 2172 meat and meat products samples were examined by using ISO culture method. Out of 478 pork samples examined 45 (9.41%) contained *L. monocytogenes*. Out of the 317 samples of beef the microorganism was found in 27 (8.51%). Out of 84 cooked sausage samples *L. monocytogenes* was isolated from 2 (2.38%) samples. None of the 1293 pasteurized canned pork ham was positive for *L. monocytogenes*. Out of 633 raw fish samples *L. monocytogenes* was found in 8 (1.26%). Besides *L. monocytogenes* was found in 4 (0.88%) out of 451 smoked fish samples. *L. monocytogenes* was not detected in 34 fish marinated product samples examined.

Key words: food of animal origin, *Listeria monocytogenes*, contamination.

*Listeria monocytogenes* has been recognized for many years as a facultatively pathogenic bacterium causing a serious illness in man and animals, called listeriosis (4, 14, 20). Listeriosis affects most often the pregnant uterus, central nervous system, or blood circulation (2, 4, 15). More recently a new form of the disease has been recognized: it is characterized by mild disorders of the gastrointestinal system and short incubation time (17). Although human listeriosis occurs infrequently, at annual rate of 2 cases per million, fatality is high, usually in the range of 20 – 30 % (2, 4, 14, 17). In the last 15 – 20 years there has been an increasing world-wide concern about *L. monocytogenes* and its implications in food safety (4, 14, 17). Although other routes of transmission have been described, indistinguishable strains have been isolated from epidemic cases and from those implicated in food, clearly identifying the role of food in the epidemiology of listeriosis (14, 17, 20). Several large well documented foodborne outbreaks and sporadic cases have been described. In most of these foodborne listeriosis cases the sources of infection were various food products such as milk and milk products, meat and meat products, and others (14, 17). The evidence that the gastrointestinal tract is an important route of infection and that the epithelial cells of the intestine may be the primary site of entry for these bacteria has been provided by electron microscopy studies of tissues of infected guinea pigs and the occurrence of foodborne infections (16). Nowadays, it is widely recognized that the consumption of contaminated food is an important route of transmission of human listeriosis. In many surveillance studies it has been found that these food products are very often contaminated by virulent strains of *L. monocytogenes* (1, 5, 6, 11, 13, 18). Taking these facts into account, there is a need for continued vigilance and surveillance of *L. monocytogenes* in food from regulatory and epidemiological point of view.

Therefore, the present study was undertaken to determine the prevalence of *L. monocytogenes* in selected raw materials and food products of animal origin in Poland.

Material and Methods

Examined materials. A total of 1118 fish and fish product samples comprising of: 633 raw fish, 451 smoked fish, and 34 marinated fish products. Moreover, 478 pork, 317 beef, 84 cooked sausages and 1293 pasteurized pork ham samples were examined. Samples of fish and fish products were taken during an official control in various fish processing plants all over Poland by Veterinary Inspectors. Samples of meat, meat products were taken from the slaughter-houses and meat processing plants by Veterinary Inspectors during an official control. The collected samples were transported to the laboratories under refrigeration and kept at 0-4°C until tested. In the studies performed in the years 1997 - 2001 the following laboratories were involved: Department of Hygiene of Food of Animal Origin, National Veterinary Research Institute in Pulawy, and 8 Regional Veterinary Laboratories (Białystok, Gdańsk, Kielce, Krosno, Łódź, Olsztyn, Poznań, Szczecin).
**Procedure of sample examination.** Culture method was based on International Standard ISO 11290-1:1996 (7). For primary enrichment, 25 g of each of the collected food samples was transferred to 225 ml of Half-Fraser broth. After 24 h incubation of primary enrichment broth, 1 ml of the culture obtained was transferred to a tube containing 10 ml of secondary enrichment broth, the Fraser broth. Inoculated Fraser broth was incubated for 48 h at 37°C and at 24 and 48 h of incubation a portion of the culture was taken with a loop for inoculating of the surface of Oxford and Palcam agars. After incubation for 48 h at 37°C the plates were examined for the presence of colonies presumed to be *Listeria* spp. Colonies suspected to be *Listeria* spp. were selected for further confirmatory tests indicated in ISO 11290-1:1996 (7). The isolated strains were checked for biochemical properties, i.e. ability to produce acid from rhamnose and xylose, MR - VP reactions, haemolysis on horse blood agar.

**Results**

As shown in Table 1, out of 478 pork samples examined 45 (9.41%) contained *L. monocytogenes*. Of the 317 samples of beef *L. monocytogenes* was found in 27 (8.51%). Out of 84 cooked sausage samples *L. monocytogenes* was isolated from 2 (2.38%) samples. None of the 1293 pasteurized canned pork ham was positive for *L. monocytogenes*. The prevalence of *L. monocytogenes* in fish and fish products are presented in Table 2. Out of 633 raw fish samples *L. monocytogenes* was found in 8 (1.26%). Besides *L. monocytogenes* was found in 4 (0.88%) out of 451 smoked fish samples. *L. monocytogenes* was not detected in 34 marinated fish product samples examined.

**Table 1**
Prevalence of *L. monocytogenes* in pork, beef, cooked sausages and canned pork ham samples

<table>
<thead>
<tr>
<th>Product</th>
<th>No. of samples examined</th>
<th>No. of positive samples (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pork</td>
<td>478</td>
<td>45 (9.41)</td>
</tr>
<tr>
<td>Beef</td>
<td>317</td>
<td>27 (8.51)</td>
</tr>
<tr>
<td>Cooked sausages</td>
<td>84</td>
<td>2 (2.38)</td>
</tr>
<tr>
<td>Pasteurized canned pork ham</td>
<td>1293</td>
<td>0/0 (0/0)</td>
</tr>
</tbody>
</table>

**Table 2**
Prevalence of *L. monocytogenes* in raw and smoked fish and marinated fish

<table>
<thead>
<tr>
<th>Product</th>
<th>No. of samples examined</th>
<th>No. of positive samples (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw fish</td>
<td>633</td>
<td>8 (1.26)</td>
</tr>
<tr>
<td>Smoked fish</td>
<td>451</td>
<td>4 (0.88)</td>
</tr>
<tr>
<td>Marinated fish</td>
<td>34</td>
<td>0 (0.0)</td>
</tr>
</tbody>
</table>

**Discussion**

Improvement of microbial quality of raw materials and food products, changes in food technology, preservation methods and prolonged shelf-life of food products are mentioned as the main reasons for an increasing threat to the consumer health due to *L. monocytogenes*. For example, shelf-life of cooked-type sausages specially packaged is declared presently for 20-30 d, while 15 years ago it was 2-5 d. Visible signs of spoilage appear usually after 20-40 d of storage at chilling temperature. Similar situation is with pork and beef. It should be added that this bacterium belongs to the recently emerging psychrotrophic pathogenic bacteria which are capable to grow even at the temperature near 0°C and under special storage conditions such as modified atmosphere packaging (14, 17, 21). It is well known that low temperature and microaerophilic conditions enhance growth of psychrotrophic microorganisms such as *L. monocytogenes*. Presently, because of availability of modern methods of detection *L. monocytogenes* is commonly found in the environment, and it has been isolated from a variety of foods, even in processed ready to eat food products (3, 9 - 11) Generally, higher incidence rates were found in raw meats than in processed, ready-to-eat products (14, 17). The presence of *L. monocytogenes* on pork or beef carcasses results from contamination during slaughter and after slaughter processing (19). The bacterium can also be transferred to raw meat by employed workers (8).

The percentage of positive pork and beef samples for *L. monocytogenes* found in the present study are generally similar or lower than those reported by other authors (14) where 0-8% of positive samples have been found depending on the author. On the other hand, Dąbrowski *et al.* (3) in a limited examination of pork and beef samples (32 samples of each meat) in Poland...
found 57.1% and 68.2% of these samples to contain \textit{L. monocytogenes}. These data indicate that the degree of \textit{L. monocytogenes} contamination of pork and beef varies dependently on an examined area. The results obtained during examination of cooked sausages showed that only 2 (2.38%) out of 84 samples were positive for \textit{L. monocytogenes}. Probably, the presence of this pathogen resulted from a secondary post processing contamination. It has been proved in some studies that the most often this type of contamination takes place during unhygienic slicing and lack of good hygienic conditions (14, 17). It is also important that this pathogen is often present in a drip from sausages what indicates the contamination is occurring during product packing (23). In a study performed by Krockel (10) on the occurrence of \textit{L. monocytogenes} in prepackaged meat products stored under refrigeration, listeriae were isolated from 5% (4 out of 78) of ready-to-eat retail meat products, after pasteurization. Kwiatek (11) in previous studies reported the isolation of \textit{L. monocytogenes} from 3.5% samples of nonstable sausages and from 3.9% samples of semistable sausages.

The globalization and growth of international trade in fish and fishery products in Poland in recent years has made these products one of the most important items traded in Pomerania region in terms of value. This situation has prompted the emergence of new demands for control of the possible prevalence of \textit{L. monocytogenes} in imported and exported fish and fish products. The results obtained during the examination of fish indicate that \textit{L. monocytogenes} is present relatively rarely in fresh fish and can survive on smoked fish products. In many countries \textit{L. monocytogenes} has been isolated from raw fish and fishery products. However, the available data indicate some differences in the geographic distribution or prevalence on different types of products (17, 21). Its relatively high incidence in ready-to-eat and heat-treated fishery products has raised concerns about the survival and growth potential of the organisms in such products, as they are not processed further before consumption.

In conclusion, the results obtained and data presented by other authors demonstrate the ubiquitous occurrence of \textit{L. monocytogenes} in raw materials used for food production. Since \textit{L. monocytogenes} may be present in meat and fish the consumption of raw or undercooked meat or fish could be an important factor in the transmission and epidemiology of \textit{Listeria} infection. Furthermore, presence of this pathogen on ready-to-eat sausages and smoked fish shows that suitable technology parameters and post processing handling should be treated as important control measures in reduction or elimination of this kind of hazard.

References