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Frequency and characteristics of Listeria spp. in minced meat in Albanian retail market

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Abstract:

Listeriosis is the emerging bacterial zoonotic infections worldwide. Among the species of the genus *Listeria*, *Listeria monocytogens* is known as causative agent of humans and animals listeriosis. Information on the occurrence of Listeria monocytogenes and Listeria species is limited in the veterinary and public health sectors in Albania. The studies for *Listeria spp.* in the food in Albania belongs to the last ten years. This survey was conducted determinate the incidence of *Listeria spp*. in minced meat samples, collected from retail shops and supermarkets in Tirana. A total of 240 samples of raw minced meat (beef, pork and pork-beef mixed) were collected over 2010-2011 period, analyzed for the presence of *Listeria spp*. The standard techniques (ISO 11290-1, 2004) were employed for the isolation and identification of *Listeria* species, as well as biochemical identification system API-Listeria. Out of the total of 240 samples examined, 152 (63.3%) were found to be positive for *Listeria spp*. *Listeria* it was isolated during all year. *Listeria monocytogenes* was isolated in 72 (30%), *Listeria innocua* in 112 (46,6%), *Listeria seeligeri* in 8 (3.2%), *Listeria gray* in 4 (1.6%) of the analyzed samples. 28 (11.6%) out of total 240 samples showed a mixed contamination of the two, three species *Listeria*. This study indicated the high incidence rate of *L. monocytogenes* and other *Listeria* species in retail minced meat of the Tirana market. This highlights the possibility of *Listeria spp* or *L.monocytogenes* to persist in not cooked well minced meat preparation and raises the problem of illness for the public..

Keywords: raw minced meat, retail market, *Listeria spp.*, *Listeria monocytogenes*, Tirana market, Albania.

1. Introduction

Actually it is evident a large increase in the production and consumption of meat and meat products, also there is an increasing consumer demand for a health, safe and balance diet [34]. Meat and meat products are excellent substrates for microorganisms growth [13]. Meat and meat products are classified as epidemiologically hazardous food which may be contaminated with bacteria from the Listeria genus. These Gram-positive rod-shaped bacteria can contaminate fresh meat during processing from many sources: air, contaminated water and/or during the distribution. Studies have confirmed that feces of healthy animals contain Listeria organisms [5,6,21,29]. Lymph glands have been also shown to be sources of contamination [21,29]. Listeria species are ubiquitous in the environment and possess physiological characteristics that allow growth at refrigeration temperature. The organism can also tolerate a pH between 5.4 and 9.6 [25].

Listeriosis is one of the important emerging bacterial zoonitic diseases that occur in humans a variety of animals. It arises mainly from the consumption of contaminated food products [1]. Reports indicate that listeriosis has emerged to be more important in developed countries but is reported less frequently in developing countries [2]. Among the different species of the genus *Listeria*, *L. monocytogenes* has been known to cause listeriosis in humans and animals [8,28].

The marked increase of contamination in food industry especially meat and chicken products by pathogenic bacteria has raised a great public concern. *Listeria spp.* especially *L. monocytogenes* has been associated with a wide variety of food sources particularly as a meat and chicken.

Various studies have shown that people at greater risk are pregnant women and foetal children, alcoholics, drug abusers, patients with corticosteroid therapy, AIDS patients and the elderly [2,15,17].The available current literature shows that *L. monocytogenes* and other *Listeria species* have been reported from a wide variety of food types and clinical samples in various countries of the world [7,10,25,30,31].

The genus *Listeria includes* 6 different species (*L. monocytogenes*, *L. ivanovii*, *L. innocua*, *L. welshimeri*, *L. seegligeri* and *L. grayi*). Both *L. ivanovii* and *L. monocytogenes* are pathogenic in

mice, but only *L. monocytogenes* is consistently associated with human illness.

Published information on the status of food borne listeriosis is very limited in the veterinary and public health sectors in Albania. The aim of this study is to detect and reports the frequency and distribution of *L. monocytogenes* and other *Listeria* species in retail minced meat (minced beef, minced pork, mixed minced beef and pork), in Tirana district market of Albania.

2. Material and Methods

2.1. Sample collection

In total, 240 raw minced meats samples (beef, pork or mixed) were collected from various retail shops and supermarkets in Tirana market, Albania. Samples were transported in the refrigerated boxes to the laboratory, as soon as possible, one-two hour after sampling

2.2. Microbiological examination, isolation and identification of Listeria spp.

Isolates were recovered using standard laboratory methods for the isolation of L. monocytogenes from food (ISO 11290-1:2004) [3]. Examinations for *Listeria* were performed using a two-step enrichment procedure. 25 g of raw minced meat was placed into a bag containing 225 mL of Half Fraser's broth, then meat homogenization was incubated for 24 h at 30 °C. Then 0.1 ml of broth was inoculated in 10 ml of Fraser broth, and incubated for 24 h at 37 °C. The content was transferred with inoculation loop to ALOA, PALCAM, and Oxford agar plates, which were then incubated for 48 h at 37 °C. Presumptive *L. monocytogenes* colonies on the agar plates were selected and streaked onto sheep blood agar, for hemolysis and CAMP test. For further identification of *Listeria* species, the API Listeria Identification Kit was used (API- Listeria Biomérieux) in accordance with the manufacturer's instructions.

3. Results and Discussion

The results of the microbiological examination obtained for the 240 samples minced meat tested, introduced at Table 1, pointed out to high positive rates for Listeria spp.

Raw minced meat, as expected showed a high level of contamination with *Listeria* species *Listeria spp*. were found in 152 (63.3%) of the out of 240 minced meat samples from the retail market. The level of contamination of minced meat samples by *Listeria* species varied and was high in minced pork (82.2%), followed by minced meat mixed (pork and beef) (65 %) and minced beef (47.2%). The overall findings obtain in our study, indicate a significant contamination level with *Listeria* species in minced meat, coincides with the report of other studies which indicated a 1 to 70% prevalence of *Listeria* species in meat samples [18,32]. Rayser et al. [24] reported *Listeria* contamination in 89% of minced beef meat, over 70% of minced poultry and turkey meat and 96% of pork sausages

Table 1. Detection of *Listeria* species in different minced meat types.

Sample type	***Examined***	***Positive***	Percentage
Totally	240	152	63.3%
Minced beef	110	52	47.2 %
Minced pork	90	74	82.2%
Minced mixed (pork+beef)	40	26	65 %

It is generally assumed that such products cannot be free from *Listeria* because of slaughter methods, evisceration and meat grounding, that allow greater chance for contamination. Furthermore, *Listeria* species are ubiquitous in the environment. This bacterium has ability to grow and reproduce in a range of temperature, from - 1.5 to 45°C [11,22,26], which is a serious problem for food manufacturers. People handling meat at different levels can also be sources of contamination [11].

The dominant *Listeria* species isolated in this study, as it is indicated in Table 2 was *L. innocua* 112 (46,6%) out of 240 samples. It was frequently detected in pork minced meat samples 63 (26.2 %) followed by beef minced samples 31 (12.9 %) and mixed minced samples 18 (7.5%) out of all 240 samples. As similar, *L. innocua* was the most predominantly isolated species in a variety of meat samples. It was detected in 83.3% of the raw minced meat, 57.6% of the raw chicken meat, 63.1% of the raw beef, 9.6% of the cooked red meat and 10.7% of

the cooked chicken samples [33]. A higher incidence of *L. innocua* in meat products, compared to *L. monocytogenes* was reported also in UK [23].

Listeria monocytogenes was the second most frequently detected *Listeria* species (30 %). Among the minced meat samples tested, the incidence of *L. monocytogenes* it was higher in pork minced samples 42 (17.5%), followed by beef minced samples 18 (7.5 %), mixed minced samples 12 (5%). Many authors have proved the widespread occurrence of this pathogen in raw meat [19,21]. Retail minced beef in Japan was reported to have a 12.2% contamination rates with *L. monocytogenes* [12]. Ryu et al [27] reported *Listeria spp*. were isolated from 43 (56.6%) out of 76 samples of meat products and *L. monocytogenes* occurred in 26 (34%) of the samples. Some authors emphasized on environmental conditions for the spread of *L. monocytogenes* contamination [20], others have focused on the equipments used as points of *L. monocytogenes* cross-contamination [14, 4]. The other species *Listeria* isolated during this study were *L. seeligeri* in 8 samples (3.2 %) , *L. grayi* in 4 samples (1.6%) out of 240 samples. It was interesting the fact that we detected more than one species *Listeria* in 28 samples, 11.6 %. *L. innocua* and *L. monocytogenes* were detected at the same samples.

Table 2. Distribution of Listeria species isolated from minced meat samples

Listeria species	Number of *Listeria* spp. isolated from minced meat samples				
	Minced beef	Minced pork	Minced mixed (pork and beef)	Totally	Percentage
L. monocytogenes	18 (7.5 %),	42 (17.5%),	12 (5%).	72	30%
L. innocua	31 (12.9 %)	63 (26.2 %)	18 (7.5%)	112	46.6 %
L. seeligeri	2	6	-	8	3.2%
L. grayi	1	3	-	4	1.6%
Mixed culture	8	16	4	28	11.6 %

The four species *Listeria* we have detected in minced meat samples, are mentioned also by the other authors. Donald et al [9] in beef samples examined, harbored seven Listeria species: 15 *L. monocytogenes*, 18 *L. ivanovii*, 32 *L. innocua*, 2 *L. seeligeri*, 11 *L. grayi*, 7 *L. murrayi*, and 13 *L. welshimeri* isolates, respectively. Similarly, Kamat and Nair [16] showed the presence of *L. ivanovii*, *L. seeligeri* and *L. welshimeri* in meat samples.

The tradition of consuming raw or undercooked of minced meat product, rises the public health risk associated with *L. monocytogenes*.

4. Conclusions

This study has demonstrated the high incidence and distribution of Listeria species and *L. monocytogenes* in some types of raw minced meat products such as minced beef, minced pork, minced mixed, in Tirana market Albania. The consuming undercooked of minced meat product, especially in fast-foods arises the public health risk associated with *L. monocytogenes*. The study suggests the need for additional control measure from competent authority, related to *Listeria spp*. Also food business operators should improve food safety through the implementation of hygienic measures at all levels from production to consumption with particular emphasis on food items which are consumed undercooked, or require no further heat treatment. Educational activities to alert and inform those concerned about food safety should be in focus.

5. References

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