Biotechnology in Animal Husbandry 27 (3), p 1185-1192 , 2011 ISSN 1450-9156
Publisher: Institute for Animal Husbandry, Belgrade-Zemun UDC 637.06
DOI: 10.2298/BAH1103185I

BACTERIA IN GOAT MEAT - BIOLOGICAL DANGER

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Review paper

Abstract: In the world, especially in China, India, Pakistan and Nigeria goat meat represents an important foodstuff in nutrition of people. Goat meat is being increasingly consumed in Serbia owing to its distinctive taste and desirable chemical composition. As many other types of meat, goat meat can be the source of pathogenic bacteria. Bacteria can find their way into meat of healthy goats or goats with no clinical symptoms premortally (infection) or postmortally (contamination). For these reasons EU has included in its programme of monitoring zoonosis and zoonotic agents' microbiological pathogens which cause the majority of alimentary diseases in humans today. Among them, *Campylobacter* and *Salmonella* cause by far the largest number of infections in humans and followed by *Listeria monocytogenes.*

Key words: bacteria, meat, goats, biological danger, humans

Introduction

In the world, especially in China, India, Pakistan and Nigeria goat meat represents an important foodstuff in nutrition of people *(Gefu, 1982)*. Goat meat is being increasingly consumed in Serbia owing to its distinctive taste and desirable chemical composition. As a foodstuff of animal origin it is rich in proteins, vitamins and minerals, and it contains very little fat, especially cholesterol. Growing goats and meat consumption, apart from mentioned qualitative composition, are not only conditioned by religion, tradition and customs, but also by the market and consumer habits *(Ivanović et al., 2009a,c)*.

As many other types of meat, goat meat can be the source of pathogenic bacteria. Bacteria can find their way into meat of healthy goats or goats with no clinical symptoms premortally (infection) or postmortally (contamination). Due to its composition meat represents perfect ground for the growth and development of bacteria which can cause different diseases both in humans and animals *(Akerejola et al., 1979; Molokwu, 1982; Mahendra et al., 2006; Dadi and Asrat, 2008)*. For

these reasons EU has included in its new directive on the monitoring of zoonosis and zoonotic agents microbiological pathogens which cause the majority of alimentary diseases in humans today and which can be transferred to humans from farm animals through contaminated meat and meat produce. Among them, *Campylobacter* and *Salmonella* cause by far the largest number of infections in humans and followed by *Listeria monocytogenes.*

To provide safe food, i.e. meat, there are prescribed criteria regarding microbiological correctness. EU regulation *(Commission Regulation EC No 2073/2005)* prescribe criteria related to processing hygiene and safe food. Microbiological criteria implies elements such as: analytical method, the sampling plan, microbiological limit(s), the specified point of the food chain where the limit(s) apply, the number of analytical units that should confirm to the limit(s) and the actions to be taken when the criterion is not met. According to that it is necessary to monitor hygiene in terms of longitudinal and integrated system of analytics (LISA), good manufacturing practices (GMP) and application of hazard analysis and critical control points (HACCP) in order to obtain safe goat meat, from farm to the dining table.

Campylobacter spp.

The genus *Campylobacter* is of great importance in human medicine and food safety, in addition to its veterinary importance *(Ivanović, 2008a)*. Occupational exposure may also cause infection and disease on workers in animal health facilities, animal shelters, and poultry processing plants, animal agriculture and rendering-plants *(Ivanović, 2005b)*.

Pathogenesis of *Campylobacter* infection is complex and depends on: adhesion (attachment), invasive ability and toxin production. Bacterial adhesion of *Campylobacter* spp. to the surface of epithelial cells is probably decisive factor for colonization, but the number of bacteria can also increase local concentration and secretion of bacterial products, which as a consequence has marked cytopathogenic effect. It is considered to be the primary mechanism for damage in colon mucosa, which leads to inflammation *(Jain et al., 2008)*.

Foods of animal origin have been incriminated as the main sources for campylobacter infection in humans *(Ivanović, 2008a*). Raw meat particularly from beef is widely consumed in the country increasing the likelihood of pathogen transmission to humans. For examining the presence of *Campylolobacter spp*. in foodstuff including the goat meat, standardized method ISO 10272-1:2006 is applied. There are also different molecular methods and enzymatic immunological testing applied only when examining human stool sample

Ivanović et al. (2004, 2005a) have identified the presence of this pathogen in liver, mucosa of small intestine and meat of clinically healthy lambs. Presence in the liver was 69,23% from samples tested, while in the mucosa of the small

intestine presence was 76,92%. During 2008. the same authors *(Ivanović et al., 2008b)* identified the presence of *Campylobacter* jejuni/coli in clinically healthy lambs and kids. Presence of this pathogen was percentually lower and amounted to 40% and 33, 68% of tested samples in the small intestine of lambs and kids respectively. In the liver of these animals the presence of *Campylobacter jejuni/coli* was lower and amounted to 25% and 23% in the liver of lambs and kids respectively. During the slaughtering of goats in the slaughterhouse, pathogen can be transferred from the intestinal contentss to the carcass and contaminate it *(Ivanović et al., 2007, 2009a)*. The possible explanation for high level of carcass contamination in the breast region could be a contamination of carcasses with intestinal contents during manual skinning, evisceration, washing and processing in the slaughter house (*Ivanović et al., 2009c*) or more frequent contact between operator's hand and the knife in the breast region. Another point of contamination occurs during carcass washing. The carcass wash water harboring a large amount of microorganisms flows down the length of the carcass to the breast region resulting in heavy contamination of the breast region.The intestinal tract could be the second major source of enteric pathogens during the slaughtering process.

In this way goat meat can become the intermediary that will transfer *Campylobacter jejuni/coli* to people *(Ivanović et al., 2009a)*. This is comparable to the findings reported from a previous study done in Ethiopia (10.5%) (*Dadi and Asra, 2008*) and Ireland (11.8%) (*Whyte et. al., 2004*) or in Bangladesh (*Glass et al.,1994*). But it is higher than the prevalence reported from Pakistan (5.1%), 8.1% from Norway and 2.1% from Australia (*Rosef et al., 1983*); Vanderlinde et al.1999). Different findings have been reported in different studies e.g. 6.3% in Kenya and 2.7% in Canada (*Turkson at al., 1988*). Reason from that may be presented presence of *Campylobacter* infection at goatas without clinical manifestation, way of slaughter and etc.

Salmonella spp.

Salmonella spp. is one of the first foodborn bacteria which was isolated. This microorganism lives in intestinal tract of both warm and cold-blooded animals. Some species are ubiquitous, and some are adapted to a certain host. Disease caused by these bacteria is called salmonellosis. Both humans and animals can be infected with it. In both cases it is an enteric disease od different extent, usually followed by diarrhea, but among poultry, most of the salmonella infections are without symptoms. Among goats, the most distinct clinical manifestation is abortion, especially during the second half or the last third of pregnancy. There are numerous methods to isolate *Salmonella*: culture and immunologic methods, methods of detection nucleic acids and various serologic tests. For foodstuff and feed international standard method is used-ISO 6579:2002.

In slaughterhouses, salmonella is usually transferred to the goat carcass from the skin or slaughter material. The extent of contamination depends on the degree

of infectiousness of the carrier and the hygiene during the slaughtering process. It is assumed that the prevalence increases as a result of stress during transportation of an animal to slaughterhouse and reduced hours of rest prior to slaughter *(Humphrey, 2000)*. *Salmonella* adheres to the fresh muscle tissue and is carried to the inside of the product easily (e.g. a sausage).

Goat meat and other goat meat products can be transmitters of salmonella to humans. In these foodstuffs a large number of salmonellae can be found without any change in appearance or smell. After regular technical processing salmonella is destroyed by heat, but improper food handling can make salmonella the source of contamination. *Salmonella* were ocured at goats meat worldwide. In India, (Das et al,. 1990) Salmonellae were isolated in 6% of samples from goat meat.

Maharjan et al. (2006) occured *Salmonella spp*.at 3.3% at row goat meats at Katmandy. At Far Eastn *Kadaka et al (2000)* found it, like as *Vo et al. (2006)* in Vietnam. Salmonelosis were presens in Africa too, which confirmed results of *Molla et al (2006)* in Etiopia or in Nigeria by *Akerejola et al. (1979)* and *Molokwu (1982)*. At same time were found at country with high sheep and goats production like Australia too (*Ashbolt et al., 2002)*. In Serbia *Salmonella* in goat meat were found by *Ivanović et al. (2009a)*.

Listeria spp.

Listeria monocytogenes is pathogenic for a large number of different animal species as well as for humans without any specificity for the host. Infection usually occurs in several stages: the ingress of bacteria into a host, lying of the phagosomal vacuole, multiplication in the cytosol, direct cell to cell contact during which actin is used which enables movement *(Bockserman, 2000)*. Listeriosis is of major veterinary importance animals used for food particularly in cattle, sheep and goats.

Among goats, listeriosis usually occurs after consuming contaminated silage or other feed and cause encephalitis, abortion and septicemia among goats *(Ivanović et al., 2009a)*. *Listeria monocytogenes* does not create toxins in food. Due to its omnipresence, *Listeria* in general and *L. monocytogenes* in particular is used as an indicator of hygiene in all stages of food production. Certain species of *Listeria* can spread in shop floors and remain there for a long time, so the slaughterhouse itself can be the source of this pathogen *(Ivanović et al., 2009b)*. Among humans, source is contaminated food, especially fresh meat *(Ivanović et al., 2006, 2009d)*.

Most cases of human infection with goat meat were established at countries with development goat production and where goats feed with silage *(Choi et al., 2001; Soriano et al., 2001)*. Infectious dose for peroral infection is unknown and depends on the type i.e. serotype of bacteria and sensitivity of a person. For sensitive people, infectious dose is less than 1000 microorganisms. Most often listeriosis among people occurs in urban environments, but without

clear role of animals in human infection, which indicates that food is still the source of infection. Although dairy products are identified as main carriers of this pathogen, all kinds of meat and meat products including the goat meat, can transfer these bacteria to humans. At Serbia, examination performed by *Ivanović et al. (2009b)* dont established *Listeria* infectiuon in goats meat.

Conclusion

As many other types of meat, goat meat can be the source of pathogenic bacteria. Bacteria can find their way into meat of healthy goats or goats with no clinical symptoms premortally (infection) or postmortally (contamination). Due to its composition meat represents perfect ground for the growth and development of bacteria which can cause different diseases both in humans and animals. Among them, *Campylobacter* and *Salmonella* cause by far the largest number of infections in humans and followed by *Listeria monocytogenes.* At goats meat in serbia were established *Campylobacter* and *Salmonella* and *Listeria monocytogenes* were not founad.

Acknowledgment

The research was done within the project TR 31053, "Implementation of new biotechnological solutions in breeding of cattle, sheep and goats for the purpose of obtaining biologically valuable and safe food", funded by the Ministry of Education and Science of the Republic of Serbia.

Bakterije u kozjem mesu - biološka opasnost

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Rezime

U meso zdravih koza bakterije mogu dospeti premortalno (infekcija) ili postmortalno (kontaminacija). Najveći broj infekcija ljudi izazivaju *Campylobacter* i *Salmonella*, a potom *Listeria monocytogenes*. *Salmonella* spp. može izazvati oboljenje i kod životinja i kod ljudi.

Kod koza, najistaknutiji klinički znak je abortus. *Campylobacter* spp. a naročito vrsta *Campylobacter jejuni* je uzročnik gastroenteritisa širom sveta, kako kod ljudi tako i kod životinja. *Listeria monocytogenes* je patogena za veliki broj različitih vrsta životinja kao i za ljude bez posebnih specifičnosti za domaćina. Kod koza, listerioza se obično javlja posle konzumiranja kontaminirane silaže ili druge

hrane. *Listeria* može uzrokovati encefalitis, abortus i septikemiju kod ovaca, goveda i koza ali i kod žena.

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Received 30 June 2011; accepted for publication 15 August 2011