Int. J. Curr. Res. Med. Sci. (2022). 8(6): 44-57

International Journal of Current Research in Medical Sciences

ISSN: 2454-5716

(A Peer Reviewed, Indexed and Open Access Journal)

www.ijcrims.com

Review Article

Volume 8, Issue 6 -2022

DOI: http://dx.doi.org/10.22192/ijcrms.2022.08.06.004

Review on Listeriosis in ruminant and public health significance in Ethiopia

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Abstract

Listeria monocytogenes is a bacterium mostly transmitted to man through food and it can cause mild gastroenteritis or severe infections of the blood stream and/or the central nervous system, or abortion, depending on host susceptibility.Listeriosis is a serious illness caused by eating food contaminated with the bacterium *Listeria*, which is a Gram-positive psychotropic, facultative anaerobic, none sporulating, motile, small rod. It displays characteristic tumbling motility that is facilitated by the presence of peritrichous flagella. Motility is temperature dependent, showing high motility at 20-30°C when flagellar expression is maximum.*L. monocytogenes* is ubiquitous in the environment and can be found in soil, water, faeces, silage, effluents foods and sewage. It has the ability to form biofilms which can contribute to its ability to colonize food processing facilities.The primary mode of transmission for *Listeria* is through soil contamination and ingestion of contaminated feed. Calves which develop septicemic disease may acquire infection from contamination of the cow teat from the ingestion of milk containing the organism or from cow with sub clinical bacteremia, through the navel from the environment and also as congenital infection.Infection with *L. monocytogenes* usually follows ingestion of contaminated feed and may result in septicemia, encephalitis, abortion. There are few clinical features that are unique to *listeriosis*. Therefore, clinicians must consider a variety of potential causes for infection, including viral infections (influenza) and other bacterial infections that may cause sepsis or meningitis. Cook thoroughly raw food from animal sources, such as beef, pork, or poultry. Wash raw vegetables thoroughly before eating. Keep uncooked meats separate from vegetables and from cooked foods and ready-to-eat foods. Avoid raw (unpasteurized) milk or foods made from raw milk. Wash hands, knives, and cutting board and can contact with before and after handling cooked foods

Keywords: riosis, *Listeria monocytogenes*, Public Health

1. Introduction

*Listeria monocytogenes*i (Sshlevh 2000).

Milk and milk products serve as important source of many disease producing microbes including Listeria monocytogenes, which is a Gram-positive, motile, psychotropic bacterium, and is the principal cause of listeriosis in humans and in a wide variety of animals including birds. The disease occurs in sporadic as well as in epidemic form, following the ingestion of food contaminated by this organism. In the world, it is becoming an important food-borne bacterial disease, with low incidence but high case fatality rate.(Pal *et al*., 2012 a)

Listeriosis *is* caused by several species *of Listeria*, bacterial organisms that live as saprophytes in the environment but occasionally cause disease in a wide range of vertebrates including mammals, marsupials, birds and reptiles so that organisms are most often ingested in food, where they can proliferate even at refrigeration temperatures. Most illnesses are caused by *Listeria* monocytogenes, but L. ivanovii is found occasionally, and there are rare reports of clinical cases caused by other species of *Listeria* (OIE, 2019)

L. monocytogenes has been recovered from dust, soil, water, sewage, decaying vegetation, at least 42 species of wild and domestic mammals, and 17 avian species, crustaceans, pond trout, ticks, and flies. Among food sources milk and milk products, and uncooked vegetables, fish and shellfish, ready-to-eat meat products, ground beef, and poultry have all been found to contain the organism (Gellin and Broom, 2001).

Listeriosis affects all ages and sexes, but animals less than three years of age are more commonly prone to clinical disease than older animals and the bacterial disease can is seen clinically in animals as one of four forms and is more common during the winter \or spring month's also adult animals usually get the encephalitis form, while neonates often get the septicemic or visceral form of the disease (Adrea, 2005).

Listeria monocytogenes is a bacterium mostly transmitted to man through food so it can cause mild gastroenteritis or severe infections of the blood stream and/or the central nervous system, or abortion, depending on host susceptibility. The lethality (fatality rate) of severe listeriosis ranges from 20 to 30% (Buchanan *et al.*, 2004).

Most human infections are also foodborne more over *L. monocytogenes* can be isolated transiently in the stool of 1-10% of the population. Cabbage fertilised by manure from sheep and subsequently stored at 4°C was implicated in one outbreak and other outbreaks have been associated with contaminated cheese and milk. Rarely, contacts with infected cows have caused skin infections in veterinarians (Schlech WF 3rd,1983).

Occurrence of *Listeria monocytogenes* within slaughter houses and meat processing facilities has been associated with environmental colonization, because of its ability to adapt and survive even on 'clean' equipment and rooms. However, *L. monocytogenes* can enter through infected animals and raw meat or intermediate products processed by suppliers(Boerlin and Piffaretti, 1991).

Listeria monocytogenes is the most important species in the genus *Listeria* causing human health threat and spread worldwide with specific host range even though *L .monocytogenes* is mostly responsible of human *Listeriosis* but occasionally infection with other species such as *L.seeligeri* and *L.ivanovii* has been reported. However,*L. monocytogenes* can cause a variety of diseases, including infections in pregnancy, ranging from a mild chill to a severe illness which may precipitate premature birth or miscarriage, and meningitis in newborn children. Septicemia and meningitis occur in adults, whose immunity to infection is impaired, such as those suffering from cancer or leukaemia or transplant patients (Dieterich G, etal 2006)

Starting in the 1960s, as a result of the introduction and wide spread use of refrigerators, processed foods and extended shelf life foods became more associated with listeriosis due to *L. monocytogenes*. Then,the disease primarily

affects older adults, pregnant women, newborns and adults with weakened immune systems. Today, listeriosis is regarded as a food-borne disease of serious public health concern (Swaminathan *etal*., 2008).

Listeriosis monocytogenes is transmitted from animal to animal through fecal oral routes, usually via manure contamination of the pasture or silage with the microorganism. Animal to human transmission is either directly through contact with infected animals or indirectly via milk, cheese, meat, eggs, or vegetables. The bacterium is inactivated with pasteurization; however, contamination of the pasteurized product with raw product has been reported as a source of infection. (Todar, 2003).

Several studies have reported that handling and consumption of contaminated raw broiler meat is an important risk factor for human infection. Because of the epidemiological importance of certain serotypes of *L. monocytogenes* to human health and potential transmission of the pathogen from poultry to humans, accurate detection of *L. monocytogenes* followed by subtyping methods to identify the specific serotype or genotype involved in outbreaks is essential. This report describes an unusual presentation of *Listeriosis* in adult chickens and the systematic use of molecular tests performed to diagnose *Listeriosis* in this backyard poultryflock. Also, it stresses the importance of being aware of potentially zoonotic diseases.(Tappero JW,.*etal*,1995)

Direct transmission from animals to human is possible especially among veterinarians performing gynecological interventions with aborted animals. Animals may be diseased or asymptomatic carriers of *L. monocytogenes* shedding the organism in their feces. Even in Ethiopia the most problem of the disease due to indirect transmission occur simply by consumption of food products from diseased animals reported that on-farm manufactured raw milk cheese made from cattle. Raw or contaminated milk, vegetables and ready-toeat meat have been implicated in overseas outbreaks. Contamination could be during preparation and it then multiplies during the storage process (Hiwot D,2016)

2. Literature review

2.1. Etiology

According to *listeriosis* is a serious illness caused by eating food contaminated with the bacterium *Listeria,* which is a Gram-positive psychotropic, facultative anaerobic, none sporulating,motile, small rod and it displays characteristic tumbling motility that is facilitated by the presence of peritrichousflagella. Motility is temperature dependent, showing highmotility at 20-30°C when flagellar expression is maximum. There are 7 species of *Listeria* as *L. monocytogenes, L. innocua, L. welshimeri,L. seeligeri, L. ivanovii, L. murrayi and L. grayi*.*L. monocytogenes* is the only species of listeria that is pathogenic for both humans and animals.(Chakraborty and Hain 2013)

The Genus *Listeria* contains seven species but one is most pathogenic for both animal and human being .The most important species is *L. monocytogenes* a gram positive facultatively anaerobic bacillus 0.5 to 2 microns long and 0.5 microns in diameter that is motile at temperatures between 20°C and 25°C also it is beta hemolytic in blood agar and forms a narrow band of hemolysis around the colonies (unlike *L. ivanovii*, which forms a wide band). A noteworthy characteristic of *L.monocytogenes* is its ability to grow at low temperatures; at a pH between 6 and 9, it(Painste *etal*.2007).

Listeriosis is caused by members of the genus *Listeria*, a Gram positive bacterial rod in the family *Listeriaceae*. *L.monocytogenes* is the primary pathogen in humansand animals, but *L.ivanovii* is found occasionally, and there are rare reports of clinical cases caused by *L. seeligeri*, *L. grayi* (which includes the former *L.murrayi*) and *L. innocua*. *Listeria* is a Gram-positive pathogen with the ability to adapt to a wide range of conditions such as refrigeration temperatures (2–4 °C) and acidic and high-salt conditions. *Listeria* cells are slow growers and may be rapidly outgrown by competitors (Kelly N.2015)

2.2. Epidemiology

Geographical location: Although the organism is wide spread in nature, clinical diseases in animals occur mainly in the northern and southern latitudes and are much less common in tropical and subtropical than in temperate climates. In the northern hemispheres, *Listeriosis* has a distinct seasonal occurrence, probably associated with seasonal feeding of silage, with the highest prevalence in the months of December through (Radostis, *etal*, 2007).

Listeriosis monocytogenes is ubiquitous in the environment and can be found in soil, water, faeces, silage, effluents foods and sewage. *L. monocytogenes* bacteria are widely distributed in nature, especially in the food chain. Most cases occur sporadically but foodborne and nosocomial outbreaks have been documented and Foods associated with infection include: unpasteurized milk, soft cheeses, processed meats, and contaminated vegetables. Newborns, the elderly, immunocompromised persons, and pregnant women are at greater risk of infection. About 30% of all cases occur to newborns within the first 3 weeks of life (Epidemiology, Investigation and Control,2015)

Therefore, it can survive in food processing environments and become persistent. Such persistence of *L. monocytogenes* has been shown, often for many years, at larger scale and smaller artisan facilities of different production sectors. Because *L.monocytogenes* is ubiquitous in the environment and frequently present in the processing environment, it can contaminate foods includes fish, mammal, crustacean, poultry, and ticks meat, soft cheeses and ready to eat(Gomez,*et al*, 2015)

Listeria monocytogenes has been considered a widespread bacterium in nature, as it is part of the faecal flora of many mammals and it is a common foodborne source. It is believed that the main route of bacterial transmission occurs through the consumption of contaminated food such as meat (sausages, pate, ham, salami, and chicken), vegetables, ready-to-eat seafood (such as smoked fish or mussels), raw seafood, unpasteurized milk, soft-serve ice creams, and soft cheeses (Wang *etal*, 2013)

Listeriosis is not a reportable disease, but data from two active surveillance studies performed in 1980-1982 and 1986 by the Centers for Disease Control and Prevention (CDC) indicate annual infection rates of 7.4 cases per million populations, accounting for 1,850 cases per year in the United States and for 425 deaths (Gellin*etal.*, 1986).

2.3. Mode of transmission

Listeria monocytogenes was recognized as an animal pathogen over 80 years ago, the first outbreak confirming an indirect transmission from animals to humans was reported only in 1983, in Canada's Maritime Provinces. In that outbreak, cabbages, stored in the cold over the winter, were contaminated with *Listeria* through exposure to infected sheep manure(Lynch, 2008).

The laboratory methods used to detect *L. monocytogenes* in food have improved in recent years and the organism has been found, but usually in small numbers, in many foods including raw fish, shellfish and fish products; raw meat, poultry and their products, including hot dogs and pate; raw and processed vegetables; ripened soft cheeses; ice cream; retail cook-chill meals; salads including coleslaw; raw and inadequately pasteurized milk as well as raw and liquid egg(Aureli P,*e tal*2000)

The primary mode of transmission for *Listeria* is through soil contamination and ingestion of contaminated feed. Calves which develop septicemic disease may acquire infection from contamination of the cow teat from the ingestion of milk containing the organism or from cow with subclinical bacteremia, through the navel from the environment and also as congenital infection(Group et al. 2007)

After a short incubation, *L. monocytogenes* can spread systemically and cross the blood-brain barrier or the placenta and a recent analysis of several outbreaks found that gastrointestinal symptoms appeared within 24 h of ingestion and

bacteremia occurred within 2 days (Goulet et al., 2013). However, it took an average of 9 days for CNS symptoms to emerge, and much longer (17–67 days) for pregnancy associated cases to be reported. Even with antibiotic treatment, the invasive form of *listeriosis* has a high mortality rate, particularly in immune-compromised individuals (Wing and Gregory, 2002).

In farm animals, *Liseriosis* is typically linked to consumption of poor quality silage that is contaminated with high levels of *L. monocytogenes*. Because, improperly fermented silage or pockets of improper fermentation with a high pH (>6.0) allow for multiplication of *Listeria* and some poorly fermented silages have shown *Listeria* contamination in excess of 10 cfu/g wet weight of silage. Application of molecular sub-typing methods has been used in a number of *Listeriosis* outbreaks in ruminants to characterize sources and transmission of *L. monocytogenes.* In many cases matching *L. monocytogenes* sub-types have been found in silage and in diseased animals as well as in fecal samples from asymptomatic animals (Wiedmann *et al*., 1996)

Contamination of foods by *L. monocytogenes* can occur at any point in the food chain, including on farms, in food processing plants, in retail establishments and in the home and *L. monocytogenes* can be detected in a wide range of foods, including both raw and processed foods. Many foods such as soft cheeses, hot dogs, and seafood have been implicated in listeriosis outbreaks, but *L. monocytogenes* also can be isolated from other foods such as beef, pork, fermented sausages, fresh produce and fish products(Destro *et al*., 1996)..

Inadequately pasteurized milk (or milk contaminated post-pasteurization), soft cheeses, icecream and other dairy products also are important sources of *L. monocytogenes*. Milk and milk products are considered as risk foodstuffs for *L. monocytogenes* (Pal et al., 2012b). Pregnant women can transmit the infection to their unborn fetuses in utero (through hematogenous spread) or during birth (Siegman-Igra *et al*., 2002).

Listeriosis is primarily a foodborne infection. So consuming contaminated food items has been identified as the source of infection in both sporadic and outbreak-associated cases. *Listeria* can be found in a variety of foods, including soft cheeses (e.g. Brie, Camembert, Mexicanstyle fresh cheeses, Roquefort, Bleu), hot dogs and other ready-to-eat meats, smoked fish, lettuce, coleslaw, other salad items, ready-to-eat foods purchased from store delicatessens, and raw milk. Home-made raw milk soft cheeses are a particular risk. Cross-contamination of ready-to-eat foods may also play a role in transmission. *Listeria* contamination frequently causes food product recalls (CDC, 2010).

2.4. Pathogenesis

Infection with *L. monocytogenes* usually follows ingestion of contaminated feed and may result in septicemia, encephalitis, abortion. Most *Listeria* species are destroyed by gastric acids. Use of antacids and H -blockers increases survival rate and are considered as H -blockers increases survival rate and are considered as probably penetrate the M-cells in Payer's patches in the intestine and spread, occurs via lymph and blood to various tissues. An alternative route of entry has been proposed for central nervous system (CNS) infection through damaged oral, nasal or ocular mucosal surfaces via the neural sheath of peripheral nerve endings, particularly the trigeminal nerve(Hirsh *et al*., 2004)

Pathogenic *Listeria* enters the host primarily through the intestine. The liver is thought to be the first target organ after intestinal translocation. In the liver, *Listeria* actively multiply until the infection is controlled by a cell-mediated immune response. This initial, subclinical step is thought to be common due to the frequent presence of *L. monocytogenes* in food(Werbrouck H,*.etal*,2006)
It can debilitated and immunocompromised patients, the unrestricted proliferation of *Listeria* in the liver may result in prolonged low-level bacteremia, leading to invasion of the preferred secondary target organs (the brain and the gravid uterus) and to overt clinical disease(Longhi C,*.etal*,2004)

At present, the pathogenesis of neuron *Listeriosis* not entirely understood and importantly, the required infectious dose still remains unknown. Oral infection is a common feature for both, animals and humans. However, subsequent mechanisms to access the brain are likely to differ between host species.In humans, it is assumed that *L .monocytogenes* passes the gastro intestinal barrier and spreads haematogenously to the brain (Tian *et al*., 2012).

Once organism isingested then penetrates to the intestinal mucosa and results in a clinically in-apparent infection with localization of bacteria in various organs, or a fatal septicemia. *Listeriae*localize themselves in the uterus of pregnant animals and usually cause abortion if infection takes place early in pregnancy.It is not known precisely how bacteria reach the brain in animals developing meningoencephalitis; however, they probably gain entrance through wounds in the mucosa of the oral cavity (Coetzer and Tustin,2007)

From the intestine, bacteria are then carried in macrophage cells to the liver and spleen, where most of them are destroyed by neutrophils acting in concert with Küpàer cells. Some of them can escape into the cytosol by employing the pore-forming protein *Listeriolysin* O. If the T cell–mediated immune response of the host is inadequate, *Listeria monocytogenes* can multiply in hepatocytes and macrophages freely(Kuhn, 2008).

The pathogenesis and genetics of *L. monocytogenes* have been explored extensively. For many decades, *L. monocytogenes* has been recognized as a model bacterial pathogen that induces T-cell mediated cellular immunity. Studies on the cellular pathogenesis of listeriosis showed that *L. monocytogenes* is a facultative intracellular pathogen, which has a unique ability to use host cell proteins to spread from cell-to-cell. The ability of *L. monocytogenes* to directly spread from cell-to-cell (without contact with the extracellular milieu) provides a morphological explanation, why cellular immunity plays a crucial role in the immune protection against listeriosis(Edelson BT.*etal*,2000 ;)

2. 5.Clinical sign and symptom

Initial symptoms of infection include nonspecific flu-like symptoms, nausea, vomiting, cramps, diarrhea and fever and there are few clinical features that are unique to *Listeriosis*. Therefore, clinicians must consider a variety of potential causes for infection, including viral infections (influenza) and other bacterial infections that may cause sepsis or meningitis. Symptoms can develop at any time from 2 to 70 days after eating contaminated food. Except for vertical mother–fetus transmission, most cases of *Listeriosis* begin with ingestion of the organism from a food source (Cresence, 2007)

The CNS is frequently involved in both, animal and human cases, and accounts for the high mortality rate associated with *Listeriosis*. Occur as rhomb encephalitis Most commonly, *Listeria* CNS infections in ruminants, i.e. primarily affect the brainstem, and only exceptionally as meningitis or meningoencephalitis (Bartt, 2000).. Septicemia is mainly seen in young ruminants or adults with metritis. Outbreaks of gastroenteritis with diarrhea have been described occasionally in sheep and cattle. Some of these animals can have extensive gastrointestinal hemorrhages, and sudden death is possible. Gastroenteritis may also precede or accompany septicemia. Kerato conjunctivitis can result from cranial nerve deficits that expose the cornea in rhombencephalitis, but it also occurs in animals with no other signs of *Listeriosis* (OIE, 2019).

The presentation of *Listeriosis* during pregnancy includes mild flu-like symptoms. In a series of 191 cases of *Listeriosis* in pregnancy, 32% of women had symptoms of a flu-like illness, 65% had a fever, and other symptoms included backache (21.5%) (Which may be mistaken for a urinary tract infection), headache (10.5%), vomiting/diarrhea (7%), muscle pains (4%) and sore throat (4%). Approximately 29% of the women were asymptomatic (Mylonakis, *etal*., 2002).

Pregnancy-associated *listeriosis* has generally been classified as illness occurring in a pregnant woman or in an infant age ≤ 28 days. *Listeriosis*

may result in pregnancy loss (fetal loss before 20 weeks gestation), intrauterine fetal demise (≥20 week's gestation), pre-term labor, or neonatal infection, while causing minimal or no systemic symptoms in the mother. Pregnancy loss and intrauterine fetal demise are considered to be maternal outcomes (CDC, 2010).

Neonatal *Listeriosis* commonly manifests as bacteremia, central nervous system infection, and pneumonia, and is associated with high fatality rates. Transmission of *Listeria* from mother to baby transplacentally or during delivery is almost always the source of early-onset neonatal infections (diagnosed between birth and 6 days), and the most likely source of late-onset neonatal listeriosis (diagnosed between 7–28 days) (Updated CSTE case definition, 2019).

2.6. Diagnosis

Diagnosis is based on history, clinical signs, pathological lesions and detection of the pathogen. Previous exposure of disease, feeding habits, grazing pasture and observation of signs and symptom are helpful for presumptive diagnosis. Definitive diagnosis can be made only after isolation and identification of the bacterium. Isolation of *Listeria* is not much cumbersome as it can be readily isolated. However, difficulty may occur while recovering this pathogen from birds showing the encephalitic form of disease. The ubiquitous nature, wide distribution and ability to survive for long periods outside the host's body present difficulty in concluding the source and spread of infection (Federal Office for Agriculture FOAG, n.d)

Conventional methods for isolation of *L. monocytogenes*, acceptable for international regulatory purposes, include the United States (FDA) method, the (AOAC) official method, the ISO 11290 Standards, the (USDA)-(FSIS) method and the French Standards. The preferred clinical samples for identification of the organism in culture include the brain tissue, lumbar (CSF), blood, liver, spleen, heart, aborted placenta and foetus, meconium of newborns, faeces, vomitus, and food/feed material(Jadhav *et al*., 2014).

Doctors usually diagnose *Listeria* infections with a lab test called a bacterial culture, done on a sample of a body fluid, such as blood, spinal fluid, or the placenta. The earlier *Listeriosis* is detected and treated, the better, because it can cause a serious and life-threatening infection (Rebeccs L.2017)

L. monocytogenes, its nucleic acids and antigens may be detected in the placenta, fetus (e.g., fetal stomach contents) or uterine discharges after an abortion; in the blood of septicemic animals; in samples from sites of localization, such as (CSF) or ocular swabs; and in postmortem tissue samples such as the liver, kidneys, spleen and brain(OIE, 2019).

Listeria grows on most conventional laboratory media, with small, round colonies observed on agar media after incubation for 1 to 2 days. It may be necessary to use selective media and cold enrichment (storage of the specimen in the refrigerator for a prolonged period) to detect *listeriae* in specimens contaminated with rapidly growing bacteria. *Listeria* grows well on media such as 5% sheep blood agar on which it exhibits the characteristic small zone of hemolysis around and under colonies. β-Hemolysis on sheep blood agar media can serve to distinguish *Listeria* from morphologically similar bacteria; however, hemolysis is generally weak and may not be observed initially(Sagar Aryya, 2017)

A definitive diagnosis can only be made postmortem by histopathology of the Ponto medullary region of the brainstem and by bacterial culture. Usually there are no gross lesions seen in the brain at necropsy. The characteristic microscopic lesions include multifocal asymmetrical micro abscesses and mononuclear cell meningoencephalitis (thus, the name *L. monocytogenes*) in the brainstem, anterior spinal cord and, occasionally, cerebellum. Peroxidase-antiperoxidase test, a more accurate diagnostic tool than histopathology, is used to detect degraded bacterial proteins as well as intact bacteria in formalin-fixed tissue (Todar, 2003).

2.7. Treatment

The majority of people with *Listeria* infections spontaneously clear the infection in about seven days. However, those patients at increased risk, especially pregnant women, usually require immediate IV antibiotic treatment to prevent, halt, or slow the development of more severe disease. For example, early exective antibiotic treatment of pregnant females may be lifesaving for the fetus. In general, the length of antibiotic treatment increases with the severity of the infection (Provincial Laboratory for Public Health, 2004).

The optimal antibiotic treatment for*Listeriosis* was penicillin, ampicillin, erythromycin rifampicin, chloramphenicol, tetracycline and aminoglycosides, with the exception of cephalosporin are e□ective against *L. monocytogenes*. A combination of trimethoprim and tetracycline was more e□ectives (Clark L.*etal*,2004)

Treatment involves administration of high doses of *procaine penicillin* every six hours for three to five days, then daily for an additional seven days. Forty-thousand IU per kg of body weight of procaine penicillin is needed to cross the blood brain barrier and put sufficient amounts of the antibiotic into the tissue of the goat's central nervous system. Remember that one kilogram (kg) equals 2.2 pounds (JOLLY GERMAN,1999-2020)

The standard treatment for CNS *Listeriosis* in adults is an *Ampicillin* 2 g IV every 4 hours with or without gentamicin for synergy. It is usually a disease of younger animals (under three years), as it is associated with tooth eruption and the emergence of the permanent molar teeth throughout the environment (Best treatment for Listeria in sheep, *2020*). For minor infections, medication might not be required (© 2004-2020 Health line Media UK Ltd).

The choice of treatment consists of a β-lactam antibiotic, normally *Ampicillin*. Because the penicillin is bacteriostatic, some studies have attempted drug combinations. For example, the simultaneous use of *Ampicillin* and an aminoglycoside (usually gentamicin) is one of the most useful methods, especially in patients over age 50. The dose is important in the treatment of invasive disease, which requires a dose of 6 grams or higher (B. Lorber, 2010)

In general, the length of antibiotic treatment increases with the severity of the infection. The treatment for meningitis lasts three weeks while brain abscess treatment lasts six weeks. The initial choice of antibiotics is usually IV ampicillin (Charles P.1996-2020)

2.8. Prevention and Control Measure

Cook thoroughly raw food from animal sources, such as beef, pork, or poultry. Wash raw vegetables thoroughly before eating. Keep uncooked meats separate from vegetables and from cooked foods and ready-to-eat foods. Avoid raw (unpasteurized) milk or foods made from raw milk and Wash hands, knives, and cutting boards after handling uncooked foods (CDC, 1992).

Plants must focus on preventing contamination of cooked products by *L. monocytogenes. L. monocytogenes* contamination of cooked meat products most frequently occurs when a product or food-contact surface is contaminated between the cooking and packaging steps. However, *L. monocytogenes* can also be introduced into the processing area from or by employees, equipment, animals, environmental reservoirs, or ingredients(Tompkin, 2002).

Food businesses are responsible for complying with the law. They demonstrate compliance by ensuring that the commodities and processes for which they are responsible meet regulatory requirements. If a written preventive control plan (PCP) is required, the food business develops a PCP with supporting documents, monitors and maintains evidence of its implementation, and verifies that all control measures are effective (Safe food for Canadians Regulation(SFCR,2019)).

Extensive work has been done with administration of antimicrobials in conventional food products and processing environments, most of which is applicable to poultry products as well *Listeria spp*. contamination may be mitigated through staff training and production procedures. In RTE meats and poultry, Hazard Analysis and Critical Control Points (HACCP) plans are applied to reduce chemical and biological adulterants. In poultry slaughtering control points can include the scalder, evisceration, final wash, chilling, and storage for further processing(Food Safety Inspection Service, 2014). .

Employees, through their clothing, gloves, boots, or skin coming into direct contact with the product, improperly cleaned and sanitized equipment, the environment, through airborne bacteria or aerosol moisture droplets generated in other work areas *L. monocytogenes* can grow in cool, damp environments contamination, plants must assess their product flow and identify the most likely sites of contamination. A preprocessing checklist has been developed to help processors evaluate areas of high risk(Penn State Extension,2016)

Prevention and control are difficult at the farm level. The food industry has to cope with contaminated raw materials, resulting in the need to treat them as rapidly as possible by, for example, irradiation or lactic acid. When the parameters of a food and its processing, in their relation to *Listeria* growth, are unknown, they should be investigated so that the "Hazard Analysis Critical Control Point" approach can be applied. It is necessary to investigate the vectors of contamination for the products at risk, and then to apply the appropriate measures to avert contamination (Epiz,1987)

2.9. Disease status in Ethiopia

Listeriosis monocytogenes via contaminated food and/or water, or by a zoonotic infection and in Ethiopia, a study has by a zoonotic infection. In Ethiopia, a study has and other *Listeria* species in a variety of raw and ready-to-eat food products in Addis Ababa with a prevalence of to-eat food products in Addis Ababa with a prevalence of from raw meat and dairy products like raw milk, cottage cheese and cream cake collected from the capital and five neighboring towns in Ethiopia. The serotypes of *Listeria monocytogenes* identified belonged to 1/2b, 4b and 4e (Derra, M.2013).

Although foods of animal origin such as milk, cheese, meat and poultry are consumed well in Ethiopia, published information on the status of food borne *Listeriosis* caused by *L. monocytogenes* is very limited and incomplete in both in the veterinary and public health sectors. In Ethiopia, a study has shown the presence and distribution in a variety of raw and ready- to-eat food products in Addis Ababa with a prevalence of 5.1% described 4.1% of prevalence from raw meat and dairy products like raw milk, cheese and cream cake collected from the capital and five neighboring towns in Ethiopia (Selamawit M.2014).

According to research study the overall prevalence of *Listeria* species was 28.4% and specifically that of *L. monocytogenes* was 5.6%. Taking the prevalence of *Listeria* species into consideration, cheese was found to be highly contaminated at 60%, followed by pasteurized milk samples (40%), raw milk (18.9%) and yoghurt (5%) (Eyasu *et al*., 2015).

However, nowadays there are some reports on prevalence of *L.monocytogenes* in different samples. For example, in Ethiopia (Addis Ababa) study conducted in 2004 showed that over all prevalence of 32.6% *Listeria* species out of the total 316 examined samples with high prevalence of *L. monocytogenes* in ice cream (19.6%) (Molla *et al*., 2004). Also, of the samples examined (391) in Addis Ababa in 2010, 102 (26.1%) were found to be positive for *Listeria. L. monocytogenes* was detected in 5.4% of the samples analyzed. It was isolated mainly from raw milk (13%) (Gebretsadik *et al.,* 2010).

2.10. Public health significance

Listeria is an opportunistic intracellular pathogen that has become an important cause of human foodborne infections world wid. Although

L. monocytogenes is infective to all human population groups, it has a propensity to cause especially severe problems in pregnant women, neonates, the elderly and immunosuppressed individuals and direct transmission is possible especially among veterinarians performing gynecological interventions with aborted animals. Animals may be diseased or asymptomatic carriers of *L. monocytogenes* shedding the organism in their feces (Liu, 2006).

Milk is supposed to constitute a complex ecosystem for various microorganisms including bacteria. Milk products like cheese, ice cream and curd are widely consumed and market for them has existed in many parts of the world for many generations. Raw milk and other dairy products are consumed by all age groups, including those populations at risk for contracting *Listeriosis* (Pal et al., 2012 a). The disease primarily affects older, pregnant women, newborns, and adults with weakened immune systems. However, rarely, persons without these risk factors can also be affected. Among the different species of the genus *Listeria, L. monocytogenes* has been known to cause *Listeriosis* in humans and animals (Schukken *et al*.,2003 and Pal, 2007).

Animals naturally harbor many food-borne bacteria in their intestines that can cause illness in humans, but often do not cause illness in the animals. During slaughter, meat andpoultry carcasses can become contaminated, if they are exposed to small amounts of intestinal contents (Pal, 2015; Pal and Mahendra, 2015).

Food safety has emerged as an important global issue with international trade and public health implications. *Listeria monocytogenes* associated with outbreaks have been reported from a wide variety of foods (Pal, 2013; Pal and Awel, 2014). The bacterium has been isolated from meat, poultry, milk, cheese, and other dairy products, and vegetables (Antunes *et al*., 2002; Kumar, 2011; Khan et al., 2013; Pal and Awel, 2014; Pal, 2015).

The Public Health Agency of Canada convened an expert panel in August 2008 to provide information to health care professionals and the general public on the diagnosis and management of *Listeriosis* during the recent outbreak. The following information is based on the panel's discussion and addresses what should be done for patients who have eaten food items that are suspected of being contaminated with *Listeria* and who have symptoms of diarrhea with or without fever. For healthy adults and children with a normal immune system, no *Listeria* specific investigation is required. Gastroenteritis due to *Listeria* infection has a short duration and is self-limited in this population(Public health Agency Canada, 2006).

Healthy adults and children occasionally get infected with *L. monocytogenes*, but they rarely become seriously ill. The body’s defense against *L. monocytogenes* is called “cell-mediated immunity” because it depends on our cells, especially lymphocytes called “T-cells.” Therefore, individuals whose cell-mediated immunity is suppressed are more susceptible to the devastating effects of *Listeriosis*. Pregnant women naturally have a depressed cell-mediated immune system. In addition, the systems of fetuses and newborns are very immature and are extremely susceptible to these types of infections (Richard *et al*., 2008)

Many food-borne zoonoses are of serious public health concerns with long-term sequel to various organs. Among these, *Listeriosis* can cause severe and life-threatening complications. Owing to change in food habits towards ready-to-eat products, food production systems, processing and supply, refrigeration for food preservation, interest in organic and natural products, interest in free-range birds and awareness towards better health, *Listeriosis* is now considered as an emerging food-borne zoonosis of increased public health significance(Mu`uz *et al*., 2012).

World Health Organization (WHO) defines zoonosis as those diseases and infections which are naturally transmitted between vertebrate animal and man. There are approximately 1415 Pathogens known to affect humans of which about 61% of all human pathogens are zoonotic. Nearly half of all human infectious diseases known today can be classified as Emerging and

about 75% of emerging infectious diseases are caused by zoonotic pathogens (Schukken,y.2003). Human population encounters animal disease with varying frequency depending on their Occupation geographical location and the prevailing culture of the country. Whether living in Urban or rural environment animals constantly may have close contact with human on farm (Food producing animals) at area of residence (dogs, cats, cage birds) through leisure. Activities (horse, wild life) or by virtue of the occupation of individual as veterinarians or Animal nurses. This close contact can result in the occurrence and transmission of zoonotic Disease which is naturally transmitted between vertebrate animal and man (Erdogan H,.1998).

3. Conclusion and Recommendations

Listeriosis has gained recognition as a global human and animal's pathogen because of the increasing incidence, diagnosis of infections and also, it is widespread in nature and lives naturally in food contamination and soil environments and has potential to introduce food animals and food plants. It can grow in a wide range of temperature and ph. Milk and milk products are important vehicles of *Listeriosis*, regularly causing *Listeriosis* outbreaks in different countries of the world. Good manufacturing and hygiene practices, particularly maintaining hygiene of processing machines, are the keys in preventing *Listeriosis* contamination. It is also equally important to notice that products, which may be subjected to post processing contamination, should be properly reheated before consumption by highly immune compromised persons in order to eliminate possible contamination. A food safety management system based on the principles of HACCP with regular reviews should be developed and implemented in dairy plant.

Based on the fact and information mentioned in the review the following recommendations are forwarded.

- There should be proper disposal of aborted fetus and feces of infected animal to avoid spread of the disease.
- Public health learning through Mass-media, radio and teaching livestock holder's and people who are at risk to *Listeria monocytogenes* is important People susceptible for acquiring *Listeriosis* should not consume unpasteurized milk and milk products.
- Every effort should be made to produce silage of good quality, with early cutting of grass, minimal contamination with soil or feces and ensuring optimal anaerobic fermentation, which will insure that the pH falls below 5.0; at that level, growth of *Listeria spp*.is inhibited.
- Meat products should be treated with heat before consumption which can kill *Listeria* species or reduce them to detectable level.
- There should be wear gloves when handling fetuses and specimens from aborted cow.

References

Adds request to obtain food history using CDC *Listeria* Case Report Form for all confirmed cases. These reports are part of national surveillance to detect contaminated commercial products distributed to multiple jurisdictions..and E.H. Marth. CRC press, Tayler & Francis Group, Boca Raton, Florida, USA, 2007; 85-110.

Arumugaswamy R and LF Gibson: 1999. *Listeria* in Zoo Animals and Rivers. Australian Veterinary Journal. 77(12): 819-820

B. Lorber, "*Listeria monocytogenes*," in Principles and Practice of Infectious Diseases, G. L. Mandell, J. E. Bennett, and R. Dolin, Eds., p. 2707, Churchill Livings Philadelphia, Pa, USA, 7th edition, 2010

Bartt R.: *Listeria* and atypical presentations of *Listeria* in the central nervous system. Semin. Neurol. 2000, 20: 361–73.

Bille J.: *Listerien* und Lebensmittel. BAG Bull. 2004,5: 60–63. Tian J.-Q., Bae Y.-M., Choi N.-Y., Kang D.-H., Heu S., Lee S.-Y.: Survival and growth of foodborne pathogens in minimally

Broome CV, Bibb WF, et al. The epidemiology of listeriosis in the United States-1986. Am J Epidemiol 1991; 133:392-401?

CDC Prevention guidelines Database, 1992).

Chakraborty, T. and T. Hain, 2013. Comparative.genomics: The genus *Listeria*. In The Compendium of International Symposium on Problems of *Listeriosis* (ISOPOL XVIII), 19-22.Goa India. Abstract No-BIO 22.

Clark R, Gill J, Swanney S (2004) *Listeria monocytogenes* gastroenteritis in sheep. New Zealand Veterinary Journal 52: 46-47. Link: https://bit.ly/3pk8KC3

Cresence V, Dharsana K, Lekshmi M, et al. *Listeria* — reviews of epidemiology and pathogenesis. J Microbiol Immunol Infect 2007; 40:4-13. [PubMed] Gellin BG,

den Bakker HC, Warchocki S, Wright EM, Allred AF, Ahlstrom C, Manuel CS, Stasiewicz MJ, Burrell A, Roof S, Strawn LK, Fortes E, Nightingale KK, Kephart D, Wiedmann M. Listeria floridensis sp. nov., *Listeria* aquatica sp. nov., *Listeria* cornellensis sp. nov., *Listeria* riparia sp. nov. And *Listeria* grandensis sp. Nov., from agricultural and natural environments. Int J Syst Evol Microbiol. 2014; 64 (Pt 6):1882-9.

Destro, M. T., M. F. F., Leitao, and J. F. Farber. 1996. Use of molecular methods to trace the dissemination of *Listeria monocytogenes* in a shrimp processing plant. Appl. Environ. Microbiol. 62:705-711.e74a1e549fde/Controlling-Lm-RTE-Guideline.pdf?MOD=AJPERES (https://www.fsis.usda.gov/wps/wcm/connect/d3373299-50e6-47d6-Edelson BT, Unanue ER. Curr Opin Immun 2000; 12: 425

Epidemiology, Investigation and Control: Heymann. D., ed., Control of Communicable Diseases Manual (CCDM), 20th Edition. Washington, DC, American Public Health Association, 2015.

Eyasu, T., Seyoum , Daniel A. Woldetsadi[1], Tesfu K. Mekonen, Haile A. Gezahegn and Wondwossen A. Gebreyes, 2015. Prevalence of Listeria monocytogenes in raw bovine milk and milk products from central highlands of Ethiopia, 9(11):1204-1209.Federal Office for Agriculture FOAG: Agricultural Report 2012 Summary 2012.

Food Safety Inspection Service (2014). FSIS Compliance Guideline: Controlling *Listeria monocytogenes* in Post-Lethality Exposed Ready-toEat Meat and Poultry Products. Retrieved from https://www.fsis.usda.gov/wps/wcm/connect/d3373299-50e6-47d6-a577-

Gellin, B.G. and Broom, C.V. 2001. Listeriosis. Morb. Mort. WklyRep. 261: 1313

Gomez, D., L. Pilar Iguacel, M. Rota, J. Carraminana, A. Arino and J. Yanguela, 2015. Occurrence of *Listeria monocytogenes* in Ready to-Eat Meat Products and Meat Processing Plants in Spain, Foods, 4:271-282.

Guide to Services. Provincial Laboratory for Public Health (Microbiology) and Capital HealthMedical Microbiology Laboratory. December 2004

H. L. Wang, K. G. Ghanem, P. Wang, S. Yang, and T. S. Li, "*Listeriosis* at a tertiary care hospital in Beijing, China: high prevalence of non-clustered health care-associated cases among adult patients," Clinical Infectious Diseases, vol. 56, no. 5, pp. 666–676, 2013

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Heir, E., Lindstedt, B.-A., Røtterud, O.-J., Vardund, T., Kapperud, G., Nesbakken, T., 2004. Molecular epidemiology and disinfectant susceptibility of Listeria monocytogenes from meat processing plants and human infections. International Journal of Food Microbiology 96, 85–96.

Hirsh, C.D., J.N. Maclachlan and L.R. Walklers, 2004 Veterinary Microbiology. 2ed, Black well publishing, USA. pp: 185-189.

Hiwot D, Savoinni G, Cattaneo D, Gabriella S, Martino P (2016) Bacteriological Quality of Milk in Raw Bovine Bulk Milk in the Selected Milk Collection Centers: Smallholder Dairy Processing Ethiopia. Link: https://bit.ly/2IrUO80

Jadhav S, Sevior D, Bhave M, Palombo EA. 2014. Detection of *Listeria monocytogenes* from selective enrichment broth using MALDI-TOF mass spectrometry. J Proteomics. 97:100106

Kuhn M, Scortti M, Vázquez-Boland J. Pathogenesis. In: Liu D. Handbook of *Listeria Monocytogenes*. CRC Press, 2008; pp. 97-138

Lamont, R., J. Sobel, S. Mazaki-Tovi, J. Kusanovic, E. Vaisbuch, S. Kim, N. Uldbjerg and R. Romero, 2011. *Listeriosis* in human pregnancy: a systematic review. J Perinat Med, 39:227-236

Lamont, R., J. Sobel, S. Mazaki-Tovi, J. Kusanovic, E. Vaisbuch, S. Kim, N. Uldbjerg and R. Romero, 2011. *Listeriosis* in human pregnancy: a systematic review. J Perinat Med, 39:227-236

Liu, D., 2006. Identification, sub-typing and virulence determination of *Listeria monocytogenes*: An important food borne pathogen. Journal of Medical Microbiology, 55: 645-659.

Lynch M, Painter J, Woodruff R., et al. Surveillance for foodborne-disease outbreaks — United States, 1998–2002. MMWR Surveill Summ 2006; 55(SS10):1-34. Available: www.cdc.gov/mmwr/preview/mmwrhtml/ss5510a1.htm (accessed 2008 Sept 4)

Medicine Net (1996-2020), Inc. All rights reserved.Medicine Net does not provide medical advice, diagnosis or treatment. To dar K: 2003. *Listeria monocytogenes* and *Listeriosis*. To dar's Online Textbook of Bacteriology. University of Wisconsin-Madison, Department of Bacteriology. http://textbookofbacteriology.net/Listeria.html

Mu~noz P, Rojas L, Bunsow E, Saez E, Sanchez-Cambronero L, Alcala L, Rodrıguez-Creixems M, Bouza E. 2012. *Listeriosis*: an emerging public health problem especially among the elderly. J Infect. 64:1933.

OIE Manual of Diagnostic Tests and Vaccines for Terrestrial Animals http://www.oie.int/international-standard-setting/terrestrialmanual/

Painste, J. and L. Slutsker, *Listeriosis* in humans, listeriosis and Food Safety, 3rd ed. Eds,, Ryser,, E..

Pal, M., 2007. Zoonoses.Second edition.SatyamPublishers, Jaipur, India, pp: 118-119.

Pal, M., Tesfaye, S. and Weldegebriel, S. 2012 b. Hygienic andmicrobiological aspects of ice cream. Beverage World Food,39:42-43

Peer, M., R. Nasir, D. Kakru, B. Fomda, M. Wani and Q. Hakeem, 2010. *Listeria monocytogenes* meningoencephalitis in an immunocompetent, previously healthy 20month old female child. Indian J Med. Microbiol., 28:169 171.processed vegetables at 4 and 15 °C. J. Food Sci. 2012, 77: M48–50

Public Health Agency of Canada. Notifiable Diseases On-Line. Notifiable disease incidence by age group — *Listeriosis*, 2006. Ottawa: The Agency. Available: http://dsolsmed.hc-sc.gc.ca/dsol-smed/ndis/c_age3_e.html (accessed 2008 Sept 6).

Radostits, O.M., C.C. Gay, K.W. Hincheliff and P.D. Constable, Diseases associated with *Listeria* species: Veterinary Medicine, a Textbook of the disease of cattle, sheep, pigs, Goats and Horses. 10thedition Sauders Elsevier Published Ltd., London, 2007; 805-810

Radostits, O.M., C.C. Gay, W.K. Hinchcliff and D.P.Constable, 2007. Veterinary Medicine: A Text Book of the Diseases of Cattle, Sheep, Pigs, Goats and Horses. 10 ed, Elsevier Health Science, USA.pp: 805-810.

Sammarco, M.L., Ripabelli, G., Ruberto, A., Iannitto, G., and Grasso, G.M. (1997) Prevalence of salmonellae, *listeriae* and yersiniae in the slaughterhouse environment and on work surfaces, equipment, and workers. Journal of Food Protection 60, 367–371.

Schlech, W.F., III. 2000. Epidemiology and clinical manifestations of *Listeria monocytogenes* infection. In Gram-Positive Pathogens. V.A. Fischetti, editor. American Society for Microbiology Press, Washington, D.C. 473–479.

Selamawit, M., 2014. The Prevalence, Risk Factors, Public Health Implication And Antibiogram Of *Listeria Monocytogenes* In Sheep Meat Collected From Municipal Abattoir And Butcher Shops In Addis Ababa.

Swaminathan, B. and P. Gerner-Smidt, 2007.The epidemiology of human *listeriosis*. Microbes Infect (Institut Pasteur), 9:1236—43. Wiedmann M, et al. J Clin Microbiol 1996; 34:1086.

Todar K: 2003. *Listeria monocytogenes* and *Listeriosis*. Todar's Online Textbook of Bacteriology. University of Wisconsin-Madison, Department of Bacteriology.http://textbookofbacteriology.net/Listeria.html

Tompkin, R. B. 2002. Control of Listeria monocytogenes in the food-processing environment. Journal of Food Protection 65: 709-725.

Walland J, Lauper J, Frey J, Imhof R, Stephan R, Seuberlich T, Oevermann A. *Listeriamonocytogenes* infection in ruminants: Is there a link to the environment, food and human health? A review. Schweiz Arch Tierheilkd. 2015; 157 (6):319-28

Wood, J.S., 1992. Encephalitic *listeriosis* in a herd of goats. Advances in Biological Research1(3-4): 118-121.

Schukken, Y., H., Grohn, Y.,T. and Wiedemann, M., Epidemiology of *listeriosis*. In: Torrence ME and Issacson RE (eds), Microbial food safety in animal agriculture – Current topics. Iowa State Press, Iowa, USA, 2003; 221-232.

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How to cite this article:
Belete Gobosho Kundul, Mohammedkemal Mustefa. Ame. (2022). Review on Listeriosis in ruminant and public health significance in Ethiopia. Int. J. Curr. Res. Med. Sci. 8(6): 44-57.
DOI: http://dx.doi.org/10.22192/ijcrms.2022.08.06.004