A Review: Prevalence and antimicrobial susceptibility profile of listeria species in milk products

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**ABSTRACT**

More than 200 known diseases are transmitted through food. The causes of foodborne illness include viruses, bacteria, parasites, toxins, metals, prions, and the symptoms of foodborne illness range from mild gastroenteritis to life-threatening neurologic, hepatic and renal syndromes. In the United States, foodborne diseases have been estimated to cause 6 million to 81 million illnesses and up to 9,000 deaths each year. Milk borne pathogens caused serious diseases in the human which may be related to the raw milk, improper pasteurization of milk and milk products. Some biological tools are developed for the measuring of the contamination by the pathogens. Such species like Listeria, Salmonella and Campylobacter species. Such factors which involved in the contamination catalogue between the area where impermanent cattle confinement, low milk production, low milking machine cleaning frequency, and milk storage area.

**1. Introduction**

More than 20 known diseases are transmitted through food. Listeriosis is a severe foodborne disease commonly caused by eating food contaminated with the Listeria species. Genus Listeria has six species that include Listeria monocytogenes, Listeria ivanovii, Listeria seeligeri, Listeria innocua, Listeria welshimeri and Listeria grayi (Jamiński and Khanzadi, 2011). Two types of species, L. monocytogenes and L. ivanovii, are capable of causing disease in human and animals (Konosonoka et al., 2012). Listeria causes Illness in the human which is present in the dairy products including raw milk, cheeses, deli meats and hotdogs. Illness is caused by eating the contaminated food which causes the infection (Atil, Ertas and Ozbay, 2011). L. monocytogenes is the causative agent of foodborne human listeriosis. The presence of listeriosis is usually associated with “YOP” group that includes young, old, pregnant and immunocompromised individuals. Human listeriosis is severe, with a high mortality rate and infection during pregnancy may lead to abortion or stillbirth (Rudolf and Scherer, 2001).

Recently, Listeria monocytogenes is one of the significant pathogens responsible for food-borne infection. It is frequently implicated in outbreaks of human listeriosis. Pregnant women, newborns, immunocompromised and the elderly persons are at highest risk for listeriosis (Konosonoka, Jemeljanov et al., 2012). This infection is frequently examined and informed in Europe and North America, but in Africa and other developing countries, only a few sporadic cases have been reported. In Morocco and other countries of North Africa, the studies on the incidence of listeriosis are rare (El Marnissi et al., 2013). Emerging food-borne pathogen is called the Listeria monocytogenes because recent studies showed that this microorganism transmitted through food and food products. L. monocytogenes causes listeriosis, a serious transmitted disease which follows as a result of consumption of that food with this pathogenic bacterium. Listeriosis is an important public health concern. The first reports of occurrence of Listeria in food were related to dairy product (Bing et al., 2004).

L. monocytogenes became an important foodborne pathogen in 1980s, after numerous food borne outbreaks caused by this pathogen. Many reports have verified the food borne listeriosis both sporadic and epidemic cases, almost all varieties of foods. The first reported raw milk and milk products caused listeriosis outbreaks was verified that included 49 cases, seven are fetus and 42 are in immune compromised adults (Welsey et al., 2007). Listeria monocytogenes is gram positive bacteria, facultative anaerobic, non-spor-forming, rod shaped microscropic organisms which have low G+C content. It can survive at the tolerant and thriving conditions such as low pH, low temperature and high salt conditions. Listeria is present in different or many types of environments including soil, water, silage, effluents foods and sewage. (Singh et al., 2012) With increasing the consumption of manufactured ready-to-eat foods in the whole world, Listeria monocytogenes has become known as an important opportunistic human foodborne pathogen (Ponniah et al., 2010).

L. monocytogenes are ubiquitous bacteria commonly spread in the natural environment and psychotropic. Listeria species are present in the intracellular state within monocytes and neutrophils (Walsh et al., 2001). L. monocytogenes has one to five peritrichous flagella which help in motility, which some time lost as bacteria enter in the human cell. Movement is possible as bacteria polymerize substitute into long acting tails that force bacteria to cytoplasm (Salyers and Whitt, 2002). Old cultures develop filaments which ranging is 6um to 20um in size. Listeria spp. are non-spires and capsules, spread individually and in the form of short chains, V and Y letters formed (Mahmood et al., 2001).

Microorganism are very important in food, Listeria monocytogenes recognized as a psychrophilic bacteria. L. monocytogenes caused infection is an extensive zoonosis, affecting mainly goats, sheep, and cattle herds. Listeria species are ubiquitous bacteria commonly spread in the natural environment (Herbert and Foster, 2001). This specificity of the bacteria predictably results in the contamination of various food products. Listeria spp. is extensively present in the environment and causes listeriosis, a disease that can be severe and is lethal among elderly, younger ones and immune-compromised people, with an estimated 20% case fatality rate, that might be increase up to 75% in high risk individuals. The frequency of listeriosis in developed countries is about the 0.2 to 0.8 cases per 100,000 individuals annually. The rate is not so high, but about 20% is mortality. (Hayat et al., 2008). The contamination of food by L. monocytogenes occurs along the food chain from farm animals. Cross-contamination, which can occur within the environment of food processing equipment, is considered to be a main source of Listeria contamination in processed food. L. monocytogenes is able to attach and survive on various working contact surfaces. One reason may be its ability to form biofilms (Painter et al., 2007).

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All the more quickly inactivated at higher antimicrobial focuses (Begley et al., 2002) is suggested that in the L. monocytogenes it has been underscored that the pollution of cheese or curd with a DsigB mutant. It has been demonstrated that a L. monocytogenes DsigB mutant is more impervious to vancomycin, bacitracin and nisins, impervious to no less than one anti-infection agent and tetracycline) as MICs for these operators were two-and four-fold lower, individually, for a DsigB mutant. What's more, 18 vancomycin-inducible qualities were appeared to be under sb control in L. monocytogenes, showing a part in observing and keeping up cell divider honesty.

Rudolf and Siegfried, (2001) in European red smear cheddar, the frequency of Listeria spp. was registred as 15.8%, where 6.4% of the examples were defiled with L. monocytogenes, 10.6% with L. innocua, and 1.2% with L. seeligeri. Cordano and Rocourt (2001) reported that 2 of 256 delicate cheese tests (0.8%) were sure for Listeria spp., however in hard cheese, separately. In the non-matured Turkish white cheddar, these two microorganisms were concurrent in 5% of the specimens. In herby cheddar, the pervasiveness of L. monocytogenes were resolved as 3.93%, L. ivanovii, L. innocua and L. welshimeri as 0.39%. Rudolf and Siegfried, (2001) in European red smear cheddar, the frequency of Listeria spp. was registred as 15.8%, where 6.4% of the examples were defiled with L. monocytogenes, 10.6% with L. innocua, and 1.2% with L. seeligeri. Cordano and Rocourt (2001) reported that 2 of 256 delicate cheese tests (0.8%) were sure for Listeria spp., however in hard cheese, separately. In the non-matured Turkish white cheddar, these two microorganisms were concurrent in 5% of the specimens. In herby cheddar, the pervasiveness of L. monocytogenes were resolved as 3.93%, L. ivanovii, L. innocua and L. welshimeri as 0.39%.

Tai et al. (2003) concentrated on contrasts and were accounted for by the different creators in the wholesome necessities for development of L. monocytogenes and this could be credited to hereditary and biological differing qualities, and also the underlying physiological condition of the bacterium. For instance, amino acids and vitamin necessities varied relying upon strains utilized for investigations. The basic prerequisites for the different strains could clarify why L. monocytogenes can persevere and get by in an extensive variety of natural conditions. L. monocytogenes Scott A required glucose, glutamine, isoleucine, leucine, arginine, cystine, methionine, valine, alanin, riboflavin, thiamine and thioctic acids for development, while fructose, celluliose, malton, mannozine, glucosamine, trehalose, glycerol, N-acetylgalactosamine and N-acetylmuramic acid upheld development without glucose. Their concentrate likewise showed that L. monocytogenes DsigB expression was the most widely recognized (46.3%), trailed by amikacin (31.7%), and tetracycline (20.5%). Their mix of L. monocytogenes, which were acquired from crude burger patties, were tried, while the rest demonstrated imperviousness to no less than one antimicrobial. The outcome demonstrated that imperviousness to tetracycline was the most widely recognized (46.3%), trailed by amikacin (31.7%), erythromycin (36.6%) and sulfamethoxazole-trimethoprim (17.1%).

Aygun and Pehlivanlar, (2006) in this considered the nearness of Listeria monocytogenes among all the listeria species (Meyer Broseta et al., 2003). It has been demonstrated that a L. monocytogenes DsigB mutant was impaired in its capacity to develop when presented to sub-leadly convergences of ampicillin, penicillin G, and bacteriocins, and was all the more quickly inactivated at higher antimicrobial focuses (Begley et al., 2006). Tyas et al. (2003) concentrated on contrasts and were accounted for by the different creators in the wholesome necessities for development of L. monocytogenes and this could be credited to hereditary and biological differing qualities, and also the underlying physiological condition of the bacterium. For instance, amino acids and vitamin necessities varied relying upon strains utilized for investigations.
organisms are equipped for developing with pyruvate or citrus extract in many living being's vigorous digestion system for the most part includes strains found in nature are destructive. Jofre et al. (2009) concentrated on environment in defecation and silage which implies that L. monocytogenes. Evans et al. (2004) demonstrated that Listeria strains confined from defiled food and in this way additionally on bovine hair, udder, and teat skin et al., 2009 reported milk assumes critical part in L. monocytogenes the study monocytogenes was disconnected from 26 bolster tests (20.0%). Poltronieri detailed synthetically characterized media that backing the development supplement uptake and digestion system. A few exploration groups have monocytogenes to develop and make due in generally various situations, it was still highly resistance to listeria due to general use of applied in animals, for treating the infections, diseases mostly in dairy less resistant to tetracycline. Since previous period, tetracycline has been used for 24 to 48 h. Presumptive L. monocytogenes isolates were purified and by plating on chromogenic agar Listeria and further incubation of the plates were enriched in Listeria enrichment broth and incubated for 48 h, followed together to eat nourishment and highlight the requirement for instruction and preparing preparations in sustenance security in Gaborone, Botswana. This study discovered imperviousness to penicillin G, sulphamethaxozole / trimethoprim, chloramphenicol, and tetracycline to be 42.11, 29.82, 28.30 and 22.81%, separately. Be that as it may, no disconnect was impervious to fusidic acid, methicillin, erythromycin, cephalothin and ampicillin. L. monocytogenes can grow best at more than 10% NaCl concentration. In one research, it reported that Listeria monocytogenes lived in 16% NaCl for one year period, at pH 6.0. Additional study suggested that resistance of the L. monocytogenes to common salt strengthen at the lower temperatures. The organism can live 100 days 10.53% of NaCl and the temperature is 40°C. Listeria monocytogenes is resistant to the UV radiation, X-rays and gamma rays which seriously contribute to the extensive dispersion of this bacterium.

Arslan and Özdemir, (2008) suggested that Listeria monocytogenes was segregated and emphatically distinguished by utilizing morphological and biochemical tests. From a sum of 1324 sustenance tests tried 57 (4.3%) were certain for L. monocytogenes. Out of the 57 subsets of L. monocytogenes 7 (12.3%), 3 (5.3%), 0 (0%), 27 (47.4%) and 20 (35.1%) were disconnected from cheddar, crude milk, milk (bilton), solidified cabbage and serving of mixed greens, separately. From the 5 topographical regions chose for examining in this study, Gaborone South recorded the most astounding number 19 (33.3%) of L. monocytogenes confines while Gaborone West recorded the minimum, 7 (12.3%). The discoveries in this study uncover the nearness of L. monocytogenes serotypes 1/2a and 1/2b in prepared to eat nourishment and highlight the requirement for instruction and preparing preparations in sustenance security in Gaborone, Botswana. This study discovered imperviousness to penicillin G, sulphamethaxozole / trimethoprim, chloramphenicol, and tetracycline to be 42.11, 29.82, 28.30 and 22.81%, separately. Be that as it may, no disconnect was impervious to fusidic acid, methicillin, erythromycin, cephalothin and ampicillin. L. monocytogenes can grow best at more than 10% NaCl concentration. In one research, it reported that Listeria monocytogenes lived in 16% NaCl for one year period, at pH 6.0. Additional study suggested that resistance of the L. monocytogenes to common salt strengthen at the lower temperatures. The organism can live 100 days 10.53% of NaCl and the temperature is 40°C. Listeria monocytogenes is resistant to the UV radiation, X-rays and gamma rays which seriously contribute to the extensive dispersion of this bacterium.

Lungu et al. (2009) suggested that to comprehend the capacity of L. monocytogenes to develop and make due in generally various situations, it is vital to decide the dietary necessities and in addition the instruments of supplement uptake and digestion system. A few exploration bunches have detailed synthetically characterized media that backing the development of L. monocytogenes amid high-impact brooding. None of the insignificant media portrayed could bolster the development of all Listeria strains.

Edson et al. (2009) concentrated on Animal and human pathogen L. monocytogenes was disconnected from 26 boletus tests (20%). Pöttermann et al., 2009 reported milk assumes critical part in L. monocytogenes the study of disease transmission in this manner it must be remembered that these unsafe microorganismic organisms are acquired the homestead environment by defiled food and in this way additionally on bovine hair, udder, and teat skin and afterward likewise in milk. L. monocytogenes is known as cow mastitis, conjunctivitis, and other sickness bringing on pathogen microorganisms. Evans et al. (2004) demonstrated that Listeria strains confined from contaminations have been discovered additionally in homestead environment in defection and slage which implies that L. monocytogenes strains found in nature are destructive. Jofre et al. (2009) concentrated on in many living being's vigorous digestion system for the most part includes a complete triacetylxylic corrosive (TCA) cycle, and numerous microscopic organisms are equipped for developing with pyruvate or citrus extract intermediates as the carbon and vitality source. Nonetheless, Trivett and Meyer presumed that amid vigorous brooding neither pyruvate, acetic acid derivation, isocitrate, citrate, a-ketoglutarate, malate or fumarate upheld the development of L. monocytogenes in a characterized medium, and that consideration of these substrates with glucose did not monocytes in a characterized medium. If glucose did not expand the development of L. monocytogenes contrasted with the development of glucose alone.

Morobe et al. (2009) considered the susceptibilities of all disengages to various antimicrobial specialists were tried by the plate agar strategy as institutionalized by the National Committee for Clinical Laboratory Standards. The accompanying board of antimicrobial plates and focuses were used: penicillin G, erythromycin, methicillin, ampicillin, chloramphenicol (15 g), tenidapen (15 g), tetracycline (25 g) (Mast Diagnostics, Merseyside, UK) and in cephalothin, ampicillin, gentamicin, sulphanilamethoxyde/trimethoprim and nitrofurantoin. They were acquired from the South African Bureau of Standards L. monocytogenes ATCC 19115 was utilized as the reference strain.

Morobe et al. (2009) recommended that the L. monocytogenes was segregated and emphatically distinguished by utilizing morphological and biochemical tests. From a sum of 1324 sustenance tests tried 57 (4.3%) were certain for L. monocytogenes. Out of the 57 subsets of L. monocytogenes 7 (12.3%), 3 (5.3%), 0 (0%), 27 (47.4%) and 20 (35.1%) were disconnected from cheddar, crude milk, milk (bilton), solidified cabbage and serving of mixed greens, separately. From the 5 topographical regions chose for examining in this study, Gaborone South recorded the most astounding number 19 (33.3%) of L. monocytogenes confines while Gaborone West recorded the minimum, 7 (12.3%). The discoveries in this study uncover the nearness of L. monocytogenes serotypes 1/2a and 1/2b in prepared to eat nourishment and highlight the requirement for instruction and preparing preparations in sustenance security in Gaborone, Botswana. This study discovered imperviousness to penicillin G, sulphamethaxozole / trimethoprim, chloramphenicol, and tetracycline to be 42.11, 29.82, 28.30 and 22.81%, separately. Be that as it may, no disconnect was impervious to fusidic acid, methicillin, erythromycin, cephalothin and ampicillin. L. monocytogenes can grow best at more than 10% NaCl concentration. In one research, it reported that Listeria monocytogenes lived in 16% NaCl for one year period, at pH 6.0. Additional study suggested that resistance of the L. monocytogenes to common salt strengthen at the lower temperatures. The organism can live 100 days 10.53% of NaCl and the temperature is 40°C. Listeria monocytogenes is resistant to the UV radiation, X-rays and gamma rays which seriously contribute to the extensive dispersion of this bacterium.
system. HACCP has greatly enhanced food safety, but it will not be totally
also important being for estimating the actions of different management
microbiological analysis to monitor the state of contamination at all
of pathogens in food and food processing area are significant factor of
López-Campos et al. (2012) suggested that the recognition and account
present in bulk milk samples of biological dairy farm.
Listeria monocytogenes. Listeria species were isolated mostly from the feed
with pathogenic microbes of Listeria genus species. The ratio of Listeria
coming to help the LLO in breaking primary vacuoles, and allow release of Listeria
monocytogenes cells into cytosol. Then, intra cellular development and
intra cytoplasmic multiplication take place in the cell. The mobility in cell
and spreading of L. monocytogenes cell by cell is mediated by the another
protein, which is present in cell surface, ActA enzyme which discriminates
actin into the comet tail that passed the bacteria to the cytoplasmic membrane. Enveloped is formed around the bacteria in filopodium like structures which are recognize and overcome through adjacent cells, which caused enlargement of the secondary dual membrane vacuoles. An active lytic on secondary double membrane vacuoles signals that involved the establishment of another infection cycle. According this way, L. monocytogenes present in the host tissues are protected from humoral harms of the immune system.

Jamshidi and Khanzadi, (2011) suggested that raw milk has the highest
rate of Listeria monocytogenes. In this study, total 100 samples of bulk milk were collected arbitrarily and then delivered to the Pasteurization Factory in Mashhad. Firstly, samples were enriched by using Listeria enrichment broth for the isolation and the identification of L. monocytogenes. For last identification of bacterial colonies, multiplex PCR assay was done by using different primers. These primers are specific for the reputed phosphoribosyl pyrophosphate synthetase (prs) gene of Listeria species. 4% positivity of Listeria monocytogenes was determined from the raw milk and the specificity was 100% and sensitivity was 3.5×10³ cfu ml-1 by this method. Due to the high sensitivity and specificity of multiplex PCR assay for the isolation of Listeria monocytogenes in milk, this method has been used in many studies in different countries. In this study, a total of 626 environments and food samples were cultured, and the total isolation rate of Listeria monocytogenes was 20.0% which were isolated from feed samples. Furthermore, most of these isolates were L. monocytogenes and Listeria species were isolated from the feed prepared and used in biological dairy farm and Listeria monocytogenes was not present in bulk milk samples of biological dairy farm.

López-Campos et al. (2012) suggested that the recognition and account
of pathogens in food and food processing area are significant factor of
any incorporated program to confirm the safety of foods throughout the food supply chain. Government authorities and food companies use microbiological analysis to monitor the state of contamination at all times and evaluate its propensities so as to identify emerging hazards. Microbiological analysis were L. monocytogenes and S.aureus. There was also a validation of the method with the microbiological measures developed for each food type, and also important being for estimating the actions of different management strategies based on the Hazard Analysis and Critical Control Points (HACCP) system. HACCP has greatly enhanced food safety, but it will not be totally effective until improved methods of analysis are established. These new
detection methods are the necessary technologies that will significantly
improve our food safety once incorporated in the HACCP. Microbiological analysis of foods is based on the detection of microorganisms by visual, biochemical, immunological, or genetic means, either before enrichment. Altuntas et al. (2012) studied to observed antibiotic sensitivity of the L. monocytogenes strains were isolated from animal derived foods. Disc diffusion assay was used for all fourteen Listeria monocytogenes for checking susceptible to the antibiotics, including vancomycin, penicillin G, tetracycline, rifampicin, chloramphenicol, erythromycin, gentamicin and trimethoprim. Conversely, the ratio of streptomycin and fosfomycin were 92.9% resistances and 7.1% correspondingly. These strains were not tested for multiple drug.

Wong et al. (2012) L. monocytogenes is present in food products which
causé diseases in humans. Listeria is a possible source of food processing
equipment and in processed food (Pak et al. 2002). Listeria monocytogenes can be found in working area of dairy products. It is also able to make biofilms.

Al-Mariri et al. (2013) in this studied total 766 milk samples were collected
from different dairymarts. Conventional methods used, 84 samples showed 10.96% positivity for Listeria spp. The biochemical tests were done for isolated Listeria spp. In which catalase was positive, oxidase was negative, motile and H2S did not produce. The highest occurrence of Listeria spp. was present in raw bovine milk samples 16.2%, sheep’s milk samples 12.4%, but in goat milk samples no listeria was found. L. monocytogenes was most abundantly present from raw milk where ratio is 41.6%. Other isolates were L. ivanovii 14.2%, L. innocua 17.8%, L. gravi 4.7%, L. welshimeri 19.5% and PCR has confirmed our results using the specific 165 rRNA gene and 16S-235 spacer involved in the genotypic identification of Listeria sp. The potential risk of the infection with Listeria spp. in people consuming raw and unpasteurized milk and dairy products. Enurah et al. (2013) studied that Listeria monocytogenes is present in fresh raw milk and the abattoir effluents in 6th zones of Nigeria. Bauer- Kirby disc diffusion assay was used for examining the antibiotic resistant pattern of isolates. Total 62 environments and food samples were cultured, on selective media where the positivity for L. monocytogenes was 54 (8%). Bielecki J, (2013) suggested that raw milk is accessible for the sale in every country in Latvia. Hence it is very essential to collect information about the microbial risk issues and some hazards related to raw milk production. The Risk valuation and bacterial monitoring will continue to the play vital role in guaranteeing food safety. Bielecki J et al. (2003) suggested that serious control managing agendas created for the individual milk production farms which depend upon risk analysis, hazard analysis and total quality management, and these principles are very essential for gaining safe and raw milk for the consumers and for the processing.

Tsai and Hodgson, (2013) suggested Listeria monocytogenes can consume
limited numbers of carbon sources for the energy with glucose. Thus, this microbe is essentially able to utilize different sources of energy for the survival or growth in gastrointestinal phase e.g. degradation of proteins, polymers of carbohydrates, lipids and nucleic acids. L. monocytogenes is fermentative and consumes sugars for growth and acid production. There is still limited evidence related the metabolic pathways and transport systems in which this bacteria uses in fermentation of sugars and the carbonate polymers. Al-Mariri et al. (2013) studied that recently strains of the Listeria monocytogenes are pathogenic to animals and human, whereas Listeria ivanovii are only caused diseases in animals, such as sheep and cattle (Vazquez-Boland et al., 2001). Listeria monocytogenes is recognized in the milk both healthy and infected animals (Wagner et al., 2000). It is also present in contaminated environment of milk processing, poor hygienic environment which causes the milk contamination. Listeriosis is mostly caused by food products such as soft cheeses, products made from unpasteurized milk, and ready to eat meat products.

Jamali et al. (2013) studied, Listeria species were resistant to penicillin G
tetracycline, but some are less resistant to chloramphenicol, amoxicillin acid, clindamycin, kanamycin and erythromycin. Penicillin G and tetracycline was resistance to Listeria spp. which is present in food. Nearly about different Listeria species were isolated which resistance to at least one antibiotics but 84.9% multidrug resistance. The ratio of multidrug resistant L. monocytogenes were L. monocytogenes resistant to rifampicin, vancomycin and gentamicin which results are related to earlier studies but lately reported that L. monocytogenes present in food showed high sensitivity to gentamicin and vancomycin. Al-Mariri et al. (2013) studied genus Listeria, which are mostly spread in the environments and regularly present in the contaminated food.
Listeria is aerobic, microaerophilic, non sporulating rods, facultative anaerobic and grow in the specific range of temperature. Listeria has been isolated from various ranges of the resources such as plants, soil, water, feces, seafood, meat, decaying vegetables, milk and dairy products. L. monocytogenes is the most important in genus, some other species are L. seeligeri, L. ivanovii, L. grayi, etc. The L. seeligeri and L. grayi, the smallest genome of this genus is present in Listeria welshimeri. Listeria monocytogenes is present in milk of the healthy and infected animals. The food products such as yogurt, meat, soft cheeses, and ready to eat products are frequently related to listeriosis.

Cerva et al. (2014) studied that milkborne pathogens spread severe diseases in human which are mostly associated with raw milk, unpasteurized milk and cheeses. Some scientific methods can be configured to detect Listeria monocytogenes in contaminated food by the pathogens. Such as Campylobacter, Listeria species and Salmonella species. Some factors which are involved in contamination index between the region where the impermanent cattle confinement, poor hygienic milking conditions, no cleaning, low milk production, and milk storage regions. Erdösi et al. (2014) have the aim of the present work was to introduce a procedure for the quick detection of Listeria monocytogenes in raw milk and soft cheese via merging of redox potential measurement methods for real time PCR and enrichment in which identification in an easy, time and the cost effective manner. The purpose of this combination was that redox potential measurement, such as an enrichment process, screening that samples which do not have L. monocytogenes. That samples which were positive for L. monocytogenes require another PCR identification. In the enrichment stage that samples which have Listeria monocytogenes screened via redox potential measurement method. But redox potential method was not differentiating between the other B. subtilis and Listeria spp. and from each other.

Saha et al. (2015) suggested that the first report was in 1929 about human listeriosis, and in 1936 first perinatal case was reported. The microorganisms have been reported to the cause disease in an extensive variety of domestic and wild animals, and have been isolated from several species of amphibians, mammals, insects, birds, fish, reptiles and crustaceans. Listeriosis is caused by transmission of microorganism in the body through food, it was recognized. It was not several too large, collective source epidemics of Listeriosis present in Europe and North America through 1980s that implication of foods as per the primary path of spread for human involvement to the Listeria monocytogenes were recognized. However, methods of the transmission for Listeria monocytogenes can include zoonotic, vertical, and nosocomial, it is commonly measured that human listeriosis, and in 1936 first perinatal case was reported. The prevalence of Listeria species was studied in Ethiopia. Romanolo and Terzi, (2015) studied were carried out to check the occurrence of L. monocytogenes, by performing the serotyping and investigation of the antibiotic resistance and sensitivity patterns in raw milk and its products. 210 total samples of milk and the milk products including white (n = 20) and kashar cheese (n = 10), farm cheese (n = 10) and kuymak (n = 10) were collected from Turkey. All these samples analyzed by an immuno magnetic separation based culture technique and the strains of Listeria monocytogenes confirmed by the occurrence of hlyA and iap genes via PCR (polymerase chain reaction). Listeria monocytogenes was recognized 5% in milk samples, serotyped as 1/2b and 4b, and 8.2% in dairy products, serotyped such as 1/2b, 1/2c and 1/2a. Whereas, Listeria monocytogenes was not recognized from kashar, butter and ice cream. The antibiotic susceptibility against ampicillin, erythromycin, amoxicillin, penicillin G, chloramphenicol, tetracycline, vancomycin and oxytetracycline were calculated by the disc diffusion method. In which that 15.3% were resistant to at minimum one drug and 36.5% were more than one drug resistant. Between all isolates, tetracycline was mostly resistance encountered 34.6%, penicillin G 23% resistance and chloramphenicol 25%. In conclusion, those studied that consuming unpasteurized raw milk and dairy products are at the risk of listeriosis in humans. Seyoum et al. (2015) studied 443 samples of milk and milk product were microbiologically investigated following techniques recommended by the U.S. Food and Drug Administration. The overall occurrence of Listeria species were 28.4% and the positivity of Listeria monocytogenes was 5.6%. The prevalence of Listeria species cheese was highly contaminated at 60%, raw milk 18.9%, pasteurized milk samples 40%, and yogurt 5%. Nogay et al. (2015) studied that L. monocytogenes is a food-borne bacterial pathogen that is associated with 20% to 30% case fatality rate. L. monocytogenes is a genetically heterogeneous species, with a small fraction of strains (serotypes 1/2a, 1/2b, 4b) implicated in human listeriosis. Monitoring and source tracking of L. monocytogenes involve the use of subtyping methods, with the performance of genetic-based methods found to be superior to phenotypic-based ones. Various methods have been used to subtype L. monocytogenes isolates, with the pulsed-field gel electrophoresis (PFGE) being the gold standard. Although PFGE has had a massive impact on food safety through the establishment of the PulseNet, there is no doubt that whole genome sequence (WGS) typing is accurate, has a discriminatory power superior to any known method, and allows genome-wide differences between strains to be quantified through the comparison of nucleotide sequences. This review focuses on the different techniques that have been used to type L. monocytogenes strains, their performance challenges, and the tremendous impact WGS typing could have on the food safety landscape.

Olaniran et al. (2015) reported that highest resistance was detected against penicillin, nalidixic acid and erythromycin, with all 78 (100%) tested for Listeria species presenting resistance, in which 83.33% was ampicillin, trimethoprim was 67.95%, nitrofurantoin was 64.10% and cephalexin was 60.26%. Gareedew et al. (2015) suggested that 57 samples were proceeded in which antimicrobial susceptibility testing of all the 57 samples, 28 (49%) were confirmed by Listeria monocytogenes. All of them isolates, 31 (54.39%) were found one or more to resistant against antibiotic. Resistant rates to, chloramphenicol, penicillin G, sulphamethoxazole/trimethoprim, and tetracycline were encountered in 29.82, 28.30, 42.11, and 22.81%, correspondingly. Antibiotic resistance was not coming across for cephalothin, methicillin, ampicillin, fusidic acid and erythromycin. There were 15 dissimilar patterns were observed which were resistant. When food products were tested, frozen salads and cabbage were verified main range of antibiotic resistance pattern. Resistance pattern that is, formation of tetracycline and penicillin G was the same between all food products that were positive for Listeria monocytogenes. Else, other were unique and atypical resistant patterns for the different food products which observed.
direct sale points were between 9.2 × 104 and 3.6 × 106 cfu/mL. Milk samples collected from 5 direct sale points revealed counts. Enterobacteriaceae ranging from 6.4 × 101 to 1.7 × 106 cfu/mL. Staphylococcus spp. bacteria were found in all milk samples, at counts ranging from 104 to 106 cfu/mL. Listeria monocytogenes bacteria were detected in 1 sample, and SCC in all samples ranged from 70,000 to 1,730,000/mL. The examined samples did not contain Salmonella rods or inhibitory substances. In the samples examined in this study, international hygiene standards were exceeded for total aerobic bacterial count (n = 48) as well as for SCC (n = 19). Two milk samples contained pathogenic bacteria (Listeria monocytogenes and Staphylococcus aureus) that pose a potential hazard for consumer health.

Allen et al. (2016) suggested that Interestingly genomic analysis of L. monocytogenes revealed a number of loci, including genes encoding putative efflux pumps, penicillin binding proteins, autolysins, and cell wall-related proteins, which are regulated or putatively regulated by sB (Begley et al., 2006). Thus, it is not surprising that sB regulates genes and operons involved in AMR in various Gram positive bacteria. In S. aureus, a SbiB mutant was more sensitive to oxacillin and vancomycin. Singh et al. (2003) studied in Bacillus subtilis, mid-logarithmic phase wild type cultures exposed to rifampin experience a reversible growth arrest partially mediated by sB, in contrast, an isogenic SbiB mutant possessed an extended growth arrest period following rifampin exposure, confirming the role of sB in rifampin tolerance.

Conclusion

Milk borne pathogens caused serious diseases in the human which may be related to the raw milk, improper pasteurization of milk and milk products. Some biological tools are developed for the measuring of the contamination by the pathogens. Such species like Listeria monocytogenes, Salmonella species and Campylobacter. Such factors which involved in the contamination catalogue between the area where permanent cattle confinement, low milk production, low milking machine cleaning frequency, and milk storage area. Recently, Listeria monocytogenes is one of the significant pathogens responsible for food-borne infection. It is frequently implicated in outbreaks of human listeriosis. Different antibiotics were used to check the susceptibility like penicillin, ciprofloxacin, ampicillin, fosfomycin, amoxicillin and gentamycin. Gentamycin and fosfomycin was very sensitive as compared to other antibiotics. So, both can be used in the treatment of listeriosis.

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