

Prevalence of *Listeria monocytogenes* in Human in Dhamar Governorate/ Yemen

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ABSTRACT: This research was conducted to investigate the existence and spread of *Listeria monocytogenes* among different ages of human. Three hundred and ten samples (310) were collected (100 male blood, 110 female blood, and 100 Placenta). The results revealed that the overall prevalence of *L. monocytogenes* in total samples was N 61 (19.7%), the isolation percentage from the Female blood N 22 (20.0%) was higher than from the Male blood N 18 (18.0%), while the isolation percentage from the placenta reached to N 21 (21.0%).

When we study the isolation rate of *L. monocytogenes* from Male blood according to Directorates , the results showed that the high rate of isolation were N 11 (31.4%) in Thamar Directorate, following Gahran N 2 (15.4%), next Ans N3 (10.7%), then Alhada N2 (9.1%), but there is no sample was isolate in Anes Directorate. Whereas the rate of isolation in Female blood according to Directorate were N 10 (29.4%) in Thamar , following N 2 (20.0%) in Anes , N 5 (17.9%) in Alhada, N 2 (14.3%) in Gahran , and N 3 (12.5%) in Ans Directorate . The highest isolation rate of the bacteria agents from placenta were in Gahran N4 (36.4%), then N9 (33.3%) in Alhada, N5 (26.3%) in Ans, N1 (16.7%) in Anes, and finally Thamar Directorate N 2 (5.4%). The results indicated that there are significant differences at ($p < 0.05$) in Prevalence of *L. monocytogenes* in Placenta according to Directorates .

This study showed that the high prevalence rate of *L. monocytogenes* from Male group aged more than (60) years, had higher opportunities to be infected with the microbe than other age groups, in this age group the isolation percentage was (30.0%), followed by the Male between forty one to fifty years was 3 (27.3%), then from thirty one to forty years where 3 (16.7%), next that from Male between the ages of twenty one to thirty years were 3 (12.5%), finally less than twenty years where 3 (11.1%).

Whereas the higher percentage of isolated *L. monocytogenes* from Female according to ages were (27.3%) between (21-30) years, followed by female with ages between forty one to fifty years, more than fifty one years, thirty one to forty years, less than twenty years, their infection percent were 3 (25.0%), 2 (22.2%), 3 (15.8%) and 2 (7.7%) respectively, and results illustrated that the highest rate of infection among pregnant women were in age groups less than 20 years with the percentage of (29.4%), followed the ages between 31-40 years were 9 (27.3%), then between 21-30 years where 7 (14.6%), while not isolated from the age between (41- 50) years. The relationship between months and prevalence of *L. monocytogenes* during period of study indicated that the highest isolation rate occurred in August (44.4%), and September (34.3%).

From this study we concluded that the prevalence of *L. monocytogenes* in human in Dhamar Governorate was high, and that human infection with these bacteria can occur at any stage of life, especially the period of age after 60 years in males and the stages in which the rate of pregnancy increases in females.

Due to the importance of this study we recommend further researches and studies on *L. monocytogenes* in different governorates of Yemen. Also working on creating specialized a national center deal with further studies and diagnosis of *L. monocytogenes*, and emphasis for inter the diagnosis of this bacteria within the routine work of the laboratories in hospitals. This study also recommends the dissemination of health awareness through the media, audio and visual media and all categories of the community male and female as well. Highlighting the health risks resulting from infection with these bacteria, and follow the scientific standards should be considered and adopted in the field of public health to prevent their transmission to humans.

Key words: *Listeria monocytogenes*, Human, Dhamar Governorate, Yemen.

INTRODUCTION

The genus *Listeria* is a member of the family *Listeriaceae*, and currently includes 17 species: *L. aquatica*, *L. booriae*, *L. cornellensis*, *L. fleischmannii*, *L. floridensis*, *L. grandensis*, *L. grayi*, *L. innocua*, *L. ivanovii*, *L. marthii*, *L. monocytogenes*, *L. newyorkensis*, *L. riparia*, *L. rocourtiae*, *L. seeligeri*, *L. weihenstephanensis*, and *L. welshimeri*¹, of which *L. monocytogenes* poses the greatest threat to human health²⁻³.

Listeria monocytogenes a virulent strain causing febrile gastroenteritis in healthy people, and invasive diseases in vulnerable populations such as pregnant women, newborns, the very young, the elderly and people who are immunocompromised, the incubation period range between 1 to 90 days, with a medium of 3 weeks, and the median incubation period in noninvasive listeriosis is one day with a range of 6 hours to 10 days⁴⁻⁶.

Most cases of listeriosis are reported in the third trimester, but the women may become infected with *L. monocytogenes* (*L. monocytogenes*) at any time during pregnancy. Usually three to seven days after the onset of symptoms, a woman may abort the fetus or have premature delivery. listeriosis may result in spontaneous abortion in the first trimester. While in case of later stages of pregnancy, the result may be stillbirth or birth of a critically sick newborn⁷. The critical target sub population for *L. monocytogenes* infection are the Pregnant women, and the pregnancy has been associated with about 18 - fold increased risk of developing disease than the non pregnant female population⁸.

L. monocytogenes is a Gram - positive, rod-shaped bacterium that form single short chains, non-spore forming bacterium which measures 0.4 μm in width and 1 to 1.5 μm in length, and it is a facultative intracellular anaerobe. The bacterium is motile being flagellated, especially below 33°C via 1-5 peritrichous flagella; it can be resistant to the effects of freezing, drying, and heat. *L. monocytogenes* has the ability to grow at low temperatures; thus, allowing it to grow in refrigerated foods with optimum temperature between 30-37°C⁹⁻¹⁰.

Nilsson¹¹ stated that the *L. monocytogenes* was a ubiquitous saprophytic bacterium and capable of causing a severe infection in humans. The organism has been recognized for 84 years, known as a human pathogen for approximately 80 years, and a food borne etiology was confirmed 27 years ago.

L. monocytogenes is a zoonotic facultative intracellular pathogen that can invade into and multiply inside of host cells. Infection with *L. monocytogenes* in humans can cause two forms of listeriosis, the non – invasive gastrointestinal form which develops as a typical febrile gastroenteritis and invasive form which can also be acquired by the fetus from its infected mother via the placenta. After *L. monocytogenes* enter into the host across the gastrointestinal epithelium, it disseminates via the blood and the lymph stream, then the bacteria establish in the spleen and the liver. From here the *L. monocytogenes* can be re-released into the blood stream and subsequently cross the fetoplacental barrier in pregnant women, besides the blood-brainbarriers for entry into the CNS, where they can cause meningitis and meningoencephalitis¹²⁻¹³.

Listeriosis is a *Listeria*-related illness characterized by flu- like symptoms; fever is generally present in patients with bacteremia, other nonspecific symptoms such as malaise, fatigue, muscle aches, gastrointestinal symptoms may also occur. When the infection with *L. monocytogenes* spreads to the nervous system, symptoms in this case may progress to include severe headache, confusion, loss of balance or convulsions and stiff neck¹⁴⁻¹⁵.

In Yemen the prevalence and the pathogenic role of *L. monocytogenes* in Humans have been neglected, therefore the objectives of this research were to study the prevalence of *L. monocytogenes* among different ages of human in Dhamar Governorate and to determine the relationship between months and prevalence of *L. monocytogenes* in human during the period of study. Also the study of the epidemiological data on *L. monocytogenes* helps in the establishing public health action that could halt transmission and therefore acquisition of the infection and aid the therapeutic program to eradicate the bacterium.

MATERIALS AND METHODS

1- Study Design and Sampling:

Three hundred and ten (310) human samples (100 Male blood , 110 Female blood, and 100 Placenta) were collected from General Thamar Hospital and some private medical laboratories. The samples were collected in dry sterile container according to (20), Personal information about patients with samples recorded; include Age, Sex, Place of residence and Directorates.

2- Isolation and Identification of *L. monocytogenes*:

In laboratory , the isolation of *L. monocytogenes* from blood was done under sterile conditions by placed 10 ml fresh blood into blood culture bottles containing 20 ml of *Listeria* Enrichment Broth (LEB) and incubated at 37°C for 48 hours , subcultures were then made on *Listeria* Oxford Medium Base (OXA) and on Brain Heart Infusion Agar (BHIA) plates by streaking , inoculated plates were incubated at 37°C for 48 hours in microaerophilic atmosphere. The isolation of *L. monocytogenes* from placenta was done by taken 5x5 cm from placenta and put in sterile Morter, added peptone water and grinded after cut into

small pieces by sterile scissors , after that transfer samples into special container containing 20 ml of Listeria Enrichment Broth (LEB) and incubated at 37°C for 48 hours , lop full from (LEB) streaking on Listeria Oxford Medium Base (OXA) and Trypticase Soy Agar (TSA) , then incubated the plates at 37°C for 48 hours in microaerophilic atmosphere¹⁶⁻¹⁷ .

After incubation period, all plates from blood and from placenta were examined to determine the properties of typical colonies of *L. monocytogenes*. These colonies are stained with Gram stain. Isolates are small, smooth and appear pale blue-green when viewed from the side (45 angle) with a beam of white light, gram positive with exposure the smear to Crystal violet for 1 min, slightly curved, tiny rods with rounded ends, often occurring in pairs at an acute angle¹⁸ , but old cultural may appear gram negative¹⁹ . The identification of *L.monocytogenes* was confirmed by Biochemical tests as listed in (Table 1)²⁰ .

3- Statistical Analysis

Statistical Analysis was done by using the Statistical Package for Social Sciences (SPSS, version 20). Used for descriptive statistics the crosstabs and used for possibility taste the Chi-Square.

RESULTS

From 310 samples of different types of human blood and placenta, 61 (19.7%) were gave a positive result for isolation of *L. monocytogenes* from total human samples. These results include 18 (18.0%) positive samples from Male blood, 22 (20.0%) positive samples from Female blood, and 21 (21.0%) positive samples from placenta (Table 1 and Figure 1). There were no significant differences between prevalence of *L. monocytogenes* in Human (Male and Female) in ($p > 0.05$).

When we study the prevalence of *L. monocytogenes* in Human blood according to Sex, we noticed that Female is more exposed (20.0%) to infection with *L. monocytogenes*, compared with Male infection rate (18.0%) (Table 3, Figure 2).

The prevalence of *L. monocytogenes* in male according to Directorate was high in Tamar Directorate(31.4%), following Gahran (15.4%), Ans (10.7%), then Alhada (9.1%), but *L. monocytogenes* did not isolate from male blood in Anes Directorate (Table 4 and Figure 3). Also the rate of isolation in Female blood according to Directorate were (29.4%) in Tamar Directorate, following (20.0%) in Anes, (17.9%) in Alhada, (14.3%) in Gahran, and (12.5%) in Anes Directorate(Table 5 and Figure 4). From 100 samples of placenta, the high rate of isolation were in Gahran (36.4%), then (33.3%) in Alhada, (26.3%) in Ans, (16.7%) in Anes and finally Tamar Directorate (5.4%) (Table 6, Figure 5). The results indicated that there are significant differences at ($p < 0.05$) in Prevalence of *L. monocytogenes* in Placenta according to Directorates

This study showed that the isolation rate of *L. monocytogenes* from Male group aged ≥ 60 years were (30.0%) , followed by the group with age between 41- 50 years (27.3%), from 31– 40 years (16.7%), then from 21 – 30 years (12.5%), finally in the group < 20 years showed (11.1%) (Table 7 and Figure

6).When we study the prevalence of *L. monocytogenes* in female according to age , we found that the age of Female between 21– 30 years of 12 participants (27.3%) have a chance to be infected more than the other age groups, followed by female with ages between 41– 50 years, ≥ 51 years, 31 – 40 years ,less than 20 years , their infection percent were; 3 (25.0%), 2 (22.2%), 3 (15.8%) and 2 (7.7%) respectively (Table 8 and Figure 7).

Other consideration which influenced the infection with *L. monocytogenes* in Pregnancy woman may be the ages factor, isolation of *L. monocytogenes* from woman less than 20 years were 5 (29.4%), followed the ages between 31-40 years were 9 (27.3%), then between 21- 30 years were 7 (14.6%), while we did not found *L. monocytogenes* in the bigger ages 41–50 years, as shown in (Table 9, Figure 8).

When we study the relationship between months and prevalence of *L. monocytogenes* in total human samples during the study period, the highest isolation rate in August 16 (44.4%), September 12 (34.3%), and April 12 (33.3%) (Table 10, Figure 9).

The relationship between directorates and abortion cases in General Thamar Hospital from 2009 to 2012 according to statistics recorded in Thamar Health Bauru were illustrated in (Table 11, Figure 10).

DISCUSSION

Listeriosis is a serious invasive illness caused by the bacterium *L. monocytogenes*, which primarily afflicts pregnant women, neonates, very young, older adults, and people with weakened immune systems.

Listeria monocytogenes is a zoonotic facultative intracellular, Gram-positive flagellated food borne pathogen causing serious disease worldwide. *L. monocytogenes* infection in humans can result in septicemia, encephalitis, meningitis, abortion, premature birth, and stillbirth. Mortality due to listeriosis is very serious leading to death in about 30% of the human cases , while in vulnerable populations such as fetuses, infants, elderly, and immunocompromised individuals , the mortality rate may be reach to 75% .

This bacterium are widely distributed in the environment , with ability to survive and multiply under low temperatures and have high tolerance ranges to both salt concentrations (10%) as well as a broad range of pH . Domestic and wild mammals, birds, and man may be asymptomatic carriers of *Listeria* in their intestinal flora. About 40 mammalian species have been shown to harbor *Listeria*, which can be isolated from intestinal samples of up to 10% of the human population.

In the study at hand, Three hundred and ten samples(310) were collected included 100 male blood, 110 female blood, and 100 Placenta samples. The overall prevalence of *L. monocytogenes* in total human samples was N 61 (19.7%), as shown in (Table 2, Figure 1). There were no significant differences between prevalence of *L. monocytogenes* in Human (Male and Female) in ($p > 0.05$). Our result was approach with percentage found by ²¹, whom found the prevalence of *L. monocytogenes* infection in human in Finland, at rate (23.0%). AlsoFugett²² in New York reported that the prevalence of *L. monocytogenes* in human samples was (24.39%). Lake,²³ in New Zealand, found that the prevalence of *L.*

monocytogenes was 21 of 24 (87.5%) among people consuming the food contaminated with *L. monocytogenes*.

Our result incompatible with the study conducted by²⁴ in Argentine, who found that the patients with Listeriosis represented (46.72%) of 122 cases. Also our result are disagreement with²⁵ who found that the prevalence of *L. monocytogenes* in human were (72.2%) in Italy. In another hand,²⁶ mentioned that the prevalence of *L. monocytogenes* among human samples were (7.3%), and⁶ in Iran, observed that (8.8%) out of 125 human samples were positive for *L. monocytogenes*.

Schuppler and loessner²⁷ mentioned that the organisms are well adapted to the conditions in the gastrointestinal tract and pursue different strategies to counteract changes in acidity, osmolality, oxygen tension, or the challenging effects of antimicrobial peptides and bile. The finding that the bacteria are able to colonize and persist in the gall bladder and suggest the occurrence of long-term and chronic infections and demonstrates the ability of pathogenic *Listeria* to survive within the various microenvironments of the gastrointestinal tract.

The total prevalence of *L. monocytogenes* in human samples according to Sex were 40 (19.0%), and the isolation rate in female blood 22 (20.0%) were higher than in Male blood 18 (18.0%), as show in (Table 3 and Figure 2).

Our result were compatible with²⁸ in Switzerland, whom isolated *L. monocytogenes* from blood in rate (21%), also they obtained that (21%) of the cases were of bacteremia, (40%) of meningitis, and (39%) of meningoencephalitis. Many studies were inconsistent with our finding , Lukinmaa et al.,²¹ in Finland , found that *L. monocytogenes* were detected in (57%) of male samples and (42%) of female samples. Lake et al.,²³ in New Zealand, mentioned that the isolation rate of *L. monocytogenes* from male and female were (51.3%) and (48.7%) respectively. Whereas in Tehran²⁹ did not found *L. monocytogenes* in a total of (398) blood samples. However, Leong et al.,³⁰ declare that *L. monocytogenes* has the ability to cross the epithelial barrier of the intestinal tract to cause more serious infection throughout the body including bacteremia, it can also cross the blood-tissue barrier which allows the bacteria to infect organs such as the brain or uterus , where it can cause severe life-threatening infections such as meningitis , encephalitis , spontaneous abortion , or miscarriage.

Table 4 and Figure 3; shown that the prevalence of *L. monocytogenes* in male blood according to Directorates. The prevalence of *L. monocytogenes* in Tamar Directorate were high (31.4%), following Gahrhan Directorate (15.4%), then Ans (10.7%), and (9.1%) in Alhada Directorate, while we did not isolate *L. monocytogenes* from Anes Directorate. The results indicated that there were no significant differences at ($p > 0.05$).

Also Table 5 and Figure 4, show that the prevalence of *L. monocytogenes* in female blood according to Directorates. The prevalence of *L. monocytogenes* were (29.4%), (20.0%), (17.9%), (14.3%)

and (12.5%), in Tamar, Anes, Alhada, Gahran and Ans Directorate respectively. The results indicated that there were no significant differences at ($p>0.05$).

The reason of high numbers of infection cases in Tamar Directorate maybe due to the presence of hospitals and health center in this urban directorate, and the population in this directorates were more awareness about the importance of diagnosis of the disease, as well as the high level of education in this directorates. In contrast, poor hygiene and sanitation and the close proximity to animals in rural directorates all contribute to easy and frequent acquisition of any enteric pathogen, including listeria.

As shown in Table 6 and Figure 5, the prevalence rate of *L. monocytogenes* in placenta according to directorates, were (36.4%) in Gahran , followed by Alhada (33.3%), Ans (26.3%), Anes (16.7%), and finally Tamar Directorate (5.4%).

The reason of high percentages of prevalence of *L. monocytogenes* in Gahran Directorate may be due to the low level of education in this rural Directorate, and lack of health awareness, as well as the absence of health program for the pregnancy women. The results indicated that there were significant differences at ($p<0.05$).

From Table 7 and Figure 6, the prevalence rate of *L. monocytogenes* in Male blood of different age's groups. The prevalence of *L. monocytogenes* in the age more than 60 years were 6 (30.0%), followed by the Male with age between 41 to 50 years were 3 (27.3%) , then from 31 to 40 years were 3 (16.7%), after that from 21 to 30 years were 3 (12.5%) , finally the age less than 20 years were 3 (11.1%) .There were no significant differences at ($p>0.05$) in prevalence of *L. monocytogenes* in male blood according to Age.

Our results were in agreement with²⁸ , who found that *L. monocytogenes* was isolates from (42%) of the patients had an underlying disease and (54%) were > 65 years of age. Patients with bacteremia were significantly older than those with meningitis or meningoencephalitis (median ages,75,69, and 55 years, respectively).

In Denmark Larsen et al.,³¹ determined *L. monocytogenes* in Male between 52 to 82 years old with septicaemia rate (3.70%), and 64 years old with meningitis were (7.14%), finally the bigger age were 86 years old with septicaemia (16.67%).Our result non-agreement with study conducted in New Zealand by²³ where the prevalence rates of *L. monocytogenes* were (45.2%) among the peoples aged over 60 years, while the prevalence rate (34.3%) among the peoples over 80 years.

When we compared between prevalence of *L. monocytogenes* in female blood according to age Table 8 and Figure 7, the result showed that the age group between 21 to 30 years was the highest age of infection 12 (27.3%) , followed by age group between 41 to 50 years 3(25.0%) , age group more than 51 years 2 (22.2%) , then age group between 31 to 40 years 3 (15.8%) , and finally the age group less than 20years 2 (7.7%). The results indicated that there were no significant differences at($p>0.05$) in Prevalence

of *L. monocytogenes* in female blood according to Age. In Atlanta,³² prevalence of *L. monocytogenes* infection was (31%) in age group < 65 years, and (53%) in patients aged \geq 65 years.

In Denmark³³ studied the prevalence of *L. monocytogenes* infection between different age groups. The prevalence of *L. monocytogenes* infection were (0.4%), (3.7%), (7.3%), (12.1%) and (22.0%) for the age groups (0-59), (60-69), (70-79), (80-89) and (90+) years respectively. Other study in Denmark³¹, found different rates between ages 58, 63, 76 and 80 years, the rates were (50.0%), (80.0%), (26.7%) and (20.67%) respectively.

In London Gillespie et al.,³⁴ reported that the prevalence rate of *L. monocytogenes* in patient < 60 years were (33%) out of 385 cases, while the prevalence rate in patient \geq 60 years were (66%) out of 783 cases. Current results were non-agreement with result found in New Zealand²³, where they found (54.8%) of the *L. monocytogenes* infection with age 60 years, and (65.7%) with age 80 years.

According to age groups in pregnancy woman the highest isolation rate of *L. monocytogenes* were in age less than 20 years (29.4%), followed by the woman with age between 31 to 40 years (27.3%), then from 21 to 30 years (14.6%), while we did not isolate *L. monocytogenes* from women in age group between 41 to 50 years, this finding can be explained in (Table 9, Figure 8). The results indicated that there were no significant differences at ($p > 0.05$) in Prevalence of *L. monocytogenes* in Pregnancy woman according to age in Tamar province.

Women infected during pregnancy may pass *L. monocytogenes* to the fetus, either transplacentally or at birth. Infection in a fetus may result in stillbirth or preterm delivery while infection in a neonate may present as meningitis or septicemia. Rare outbreaks in neonatal nurseries have been attributed to contaminated equipment or materials.

Derra,⁹ recorded that the pregnant women are about 20 times more at risk than others and about 1/3 of listeriosis cases occur during pregnancy, late in 2nd or in 3rd trimester or 3 weeks of the newborn life. In pregnant women infection of the fetus is extremely common and can lead to abortion, still birth or delivery of *Listeria* infected infant. In Alberta, prevalence of *L. monocytogenes* was (30%) in pregnant women >40 years, and (22%) in non-pregnant women more than 40 years³⁵.

The current result were inconsistent with result found by Silk et al.,³² in Atlanta, whom they found that the crude prevalence of listeriosis among Hispanic pregnancy women were increased from 5.09 to 12.37 cases per 100 000 of population for the periods of 2004–2006 and 2007–2009 respectively, while the prevalence of listeriosis among non-Hispanic pregnancy women were increased from 1.74 to 2.80 cases per 100.000 population for the same periods. Incidence rates of non-pregnancy associated listeriosis in patients aged \geq 65 years were 4–5 times greater than overall rates annually.

The results obtained in Table 10 and Figure 9 illustrated that the highest Prevalence rate of *L. monocytogenes* in total Human samples during period of study was in August, September and April (44.4%), (34.3%) and (33.3%) respectively. The results indicated that there were significant differences at

($p < 0.05$) in blood male and placenta, but there were no significant differences at ($p > 0.05$) in blood female.

In USA³⁶ reported that the isolation of *L. monocytogenes* was higher during cooler weather (28 to 92% of samples) than during warmer weather (6 and 77% of samples). Also in Greece³⁷ found that the prevalence of *L. monocytogenes* was higher in the warmer months. In Finland³⁸ found that the seasonal trend seems evident in human listeriosis cases, and the number of these cases began to rise in July and remained high until January especially in August, September, October and January.

Data which has found clear seasonal variation, including higher numbers of *Listeria* species occurring in both winter and in summer months^{36, 39}. Also FDA,⁴⁰ mentioned that infections with *L. monocytogenes* occur throughout the year. In Ireland³⁰ reported that the lowest prevalence occurred in July 2013, November 2013 and January 2014 (3.9, 3.8, and 2.0% respectively), while *L. monocytogenes* prevalence ranged between 4.2 and 6.0% for the rest of sampling months.

Depending on statistics collected from General Thamar Hospital (Table 11, Figure 10), we noticed that the recovered cases of abortion in this hospital during four years reach to 1072 cases, and the abortion cases recorded in all directorates, also this table clarify that the highest number of abortion cases were in Thamar Directorate compared with another directorates, our results agreement with the statistics achieved from the General Thamar Hospital, and this findings explain the risk of listeriosis.

CONCLUSION

Due to the importance of this study we recommend further researches and studies on *L. monocytogenes* in different governorates of Yemen, especially on the prevalence of *L. monocytogenes* in food of animal origin. Also working on creating specialized public centers deal with further studies and diagnosis of *L. monocytogenes* and emphasis for inter the diagnosis of *L. monocytogenes* within the routine work of the laboratories in hospitals. This study also recommends all people especially who do in field of food preservation and food cooking either in household or that working in restaurants to follow the following instructions: Keep clean, always wash hands with soap after going to the toilet. Separate raw and cooked food; avoid contacting between raw and cooked food and keep food at safe temperature. Cook thoroughly, especially meat and poultry. Use safe water and raw materials, wash fruit and vegetables.

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Table (1): Biochemical Tests for the Confirming of *L. monocytogenes*

Test	Reaction
Catalase	+
Oxidase	-
Indole	-
Urease	-
Gram Stain	+
Motility 25°C	+
37°C	-
H ₂ S production	-
Hemolytic (β)	+
TSI	A/A
Methyl red	+
Simmon’s citrate	-
Voges- proskaur	+

Table (2): Prevalence of *L. monocytogenes* in Total Human Samples

Samples	Total N. of Samples	Positive samples %No	Negative samples %No	p-value
Male Blood	100	18 18.0	82 82.0	0.862
Female Blood	110	22 20.0	88 80.0	
Placenta	100	21 21.0	79 79.0	
Total	310	61 19.7	249 80.3	

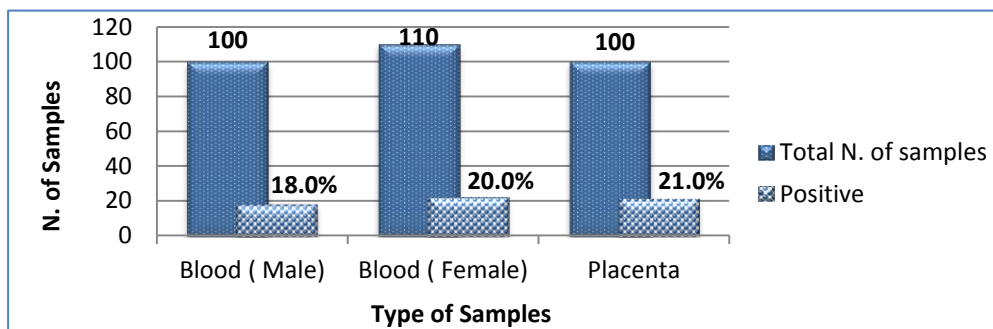


Figure (1): Prevalence of *Listeria monocytogenes* in Total Human Samples

Table (3): Prevalence of *L. monocytogenes* in Human according to Sex

Sex	Total No. of Samples	Positive		Negative	
		No.	%	No.	%
Male Blood	100	18	18.0	82	82.0
Female Blood	110	22	20.0	88	80.0
Total	210	40	19.0	170	80.9

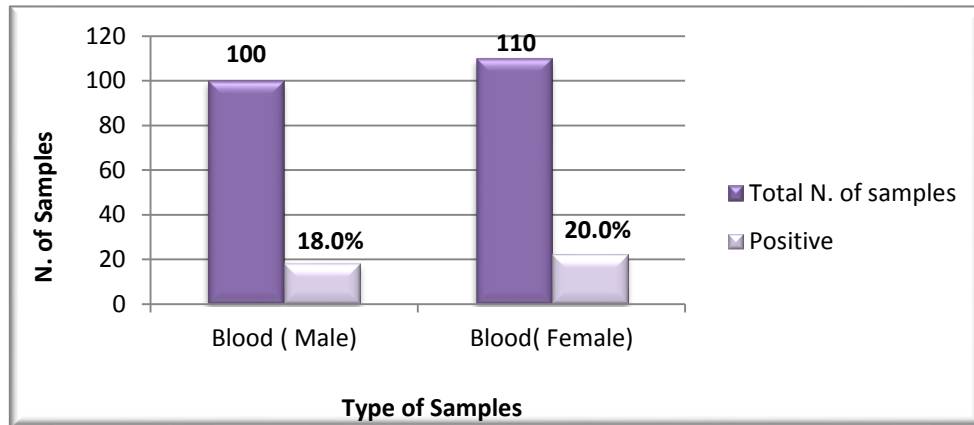


Figure (2): Prevalence of *L. monocytogenes* in Human according to Sex

Table (4): Prevalence of *L.monocytogenes* in male according to Directorates Prevalence

Directorates	Total N. of Samples	Positive		Negative		p-value
		N.	%	N.	%	
Thamar	35	11	31.4	24	68.6	.138
Alhada	22	2	9.1	20	90.9	
Ans	28	3	10.7	25	89.3	
Anes	2	0	0.0	2	100.0	
Gahran	13	2	15.4	11	84.6	
Total	100	18	18.0	82	82.0	

Figure (3): Prevalence of *L.monocytogenes* in male according to Directorates

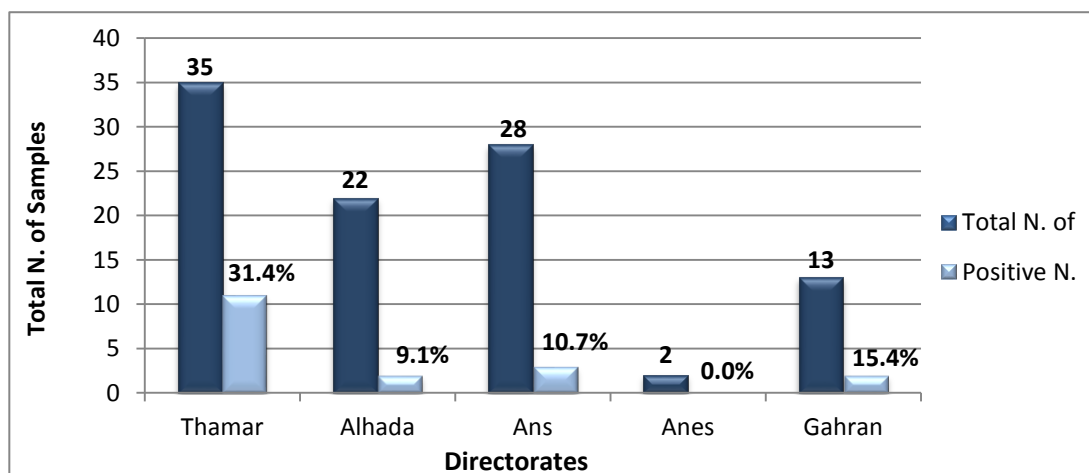


Table (5): Prevalence of *L.monocytogenes* in female according to Directorates

Directorates	Total N. of Samples	Positive		Negative		p-value
		N.	%	N.	%	
Thamar	34	10	29.4	24	70.6	.543
Alhada	28	5	17.9	23	82.1	
Ans	24	3	12.5	21	87.5	
Anes	10	2	20.0	8	80.0	
Gahran	14	2	14.3	12	85.7	
Total	110	22	20.0	88	80.0	

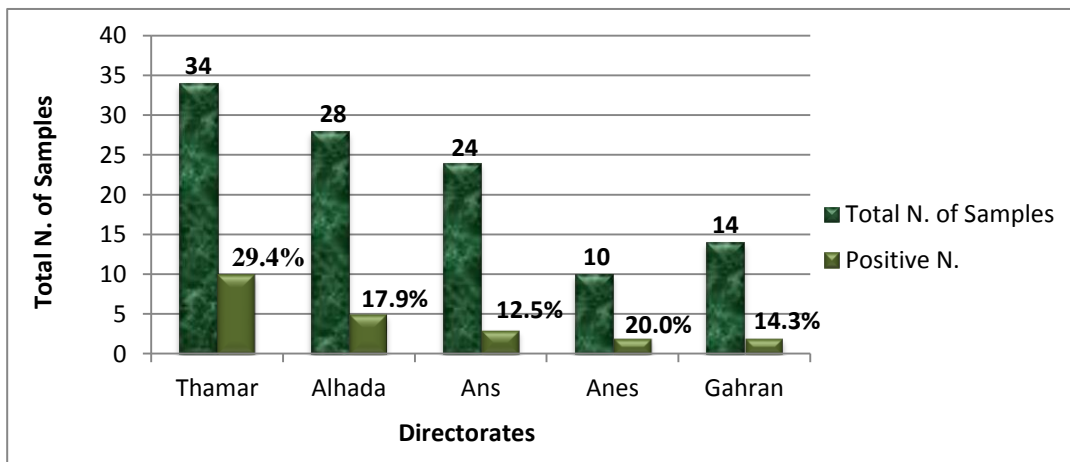


Figure (4): Prevalence of *L.monocytogenes* Female according to Directorates

Table (6): Prevalence of *L.monocytogenes* Placenta according to Directorates

Directorates	Total N. of Samples	Positive		Negative		p-value
		N.	%	N.	%	
Thamar	37	2	5.4	35	94.6	.004
Alhada	27	9	33.3	18	66.7	
Ans	19	5	26.3	14	73.7	
Anes	6	1	16.7	5	83.3	
Gahran	11	4	36.4	7	63.6	
Total	100	21	21.0	79	79.0	

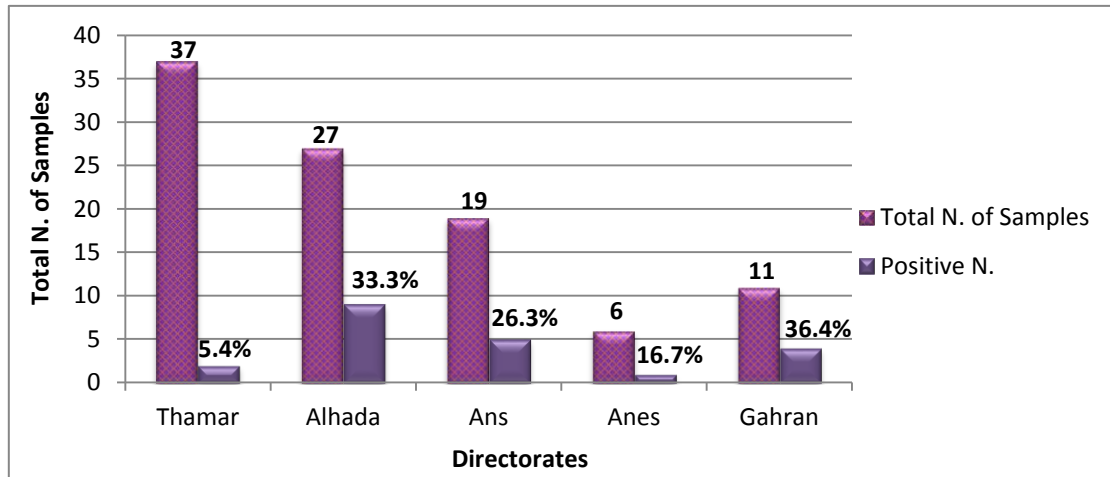


Figure (5): Prevalence of L.monocytogenes Placenta according to Directorates

Table (7): Prevalence of Listeria monocytogenes in Male Blood according to Age

Distribution of samples by Age	N. of Samples	Positive		Negative		p- value
		N.	%	N.	%	
< 20	27	3	11.1	24	88.9	0.537
21-30 years	24	3	12.5	21	87.5	
31-40 years	18	3	16.7	15	83.3	
41-50 years	11	3	27.3	8	72.7	
≥ 60	20	6	30.0	14	70.0	
Total	100	18	18.0	82	82.0	

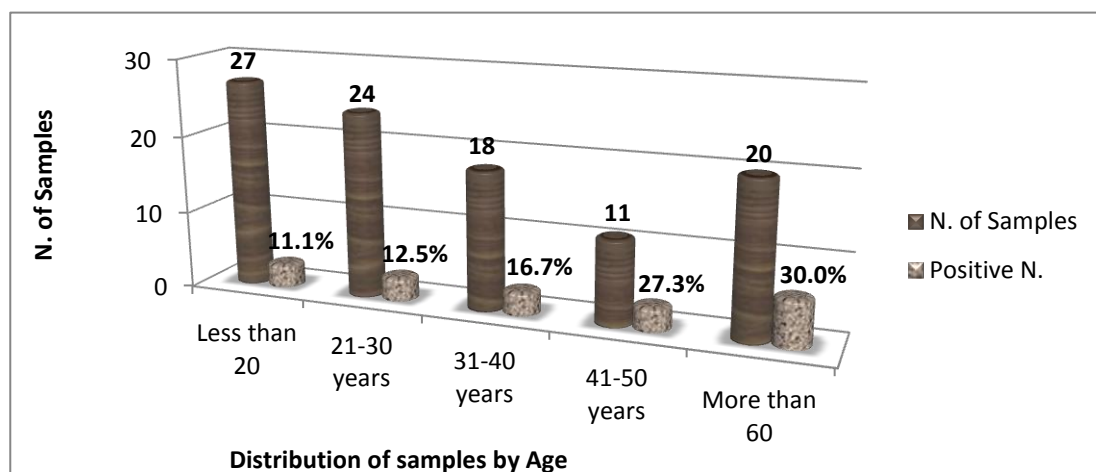


Figure (6): Prevalence of Listeria monocytogenes in Male Blood according to Age

Table (8): Prevalence of *Listeria monocytogenes* in female blood according to ages

Distribution of Samples by Age	N. of Samples	Positive		Negative		p- value
		N.	%	N.	%	
Less than 20	26	2	7.7	24	92.3	.484
21-30 years	44	12	27.3	32	72.7	
31-40 years	19	3	15.8	16	84.2	
41-50 years	12	3	25.0	9	75.0	
≥51	9	2	22.2	7	77.8	
Total	110	22	20.0	88	80.0	

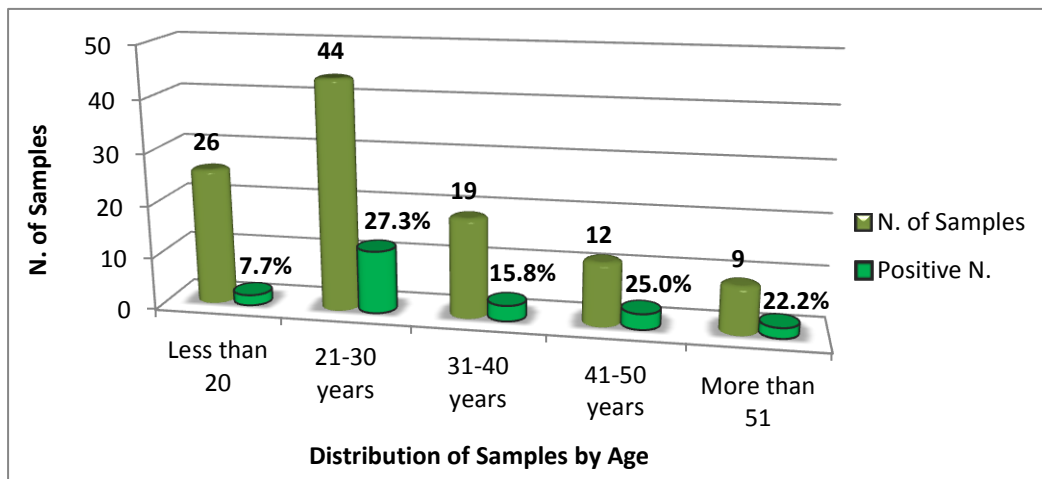


Figure (7): Prevalence of *Listeria monocytogenes* in female blood according to ages

Table (9): Prevalence of *Listeria monocytogenes* in pregnancy woman according to age in Thamar province

Distribution of Samples by Age	N. of Samples	Positive		Negative		p- value
		N.	%	N.	%	
Less than 20	17	5	29.4	12	70.6	.357
21-30 years	48	7	14.6	41	85.4	
31-40 years	33	9	27.3	24	72.7	
41-50 years	2	0	0.0	2	100.0	
Total	100	21	21.0	79	79.0	

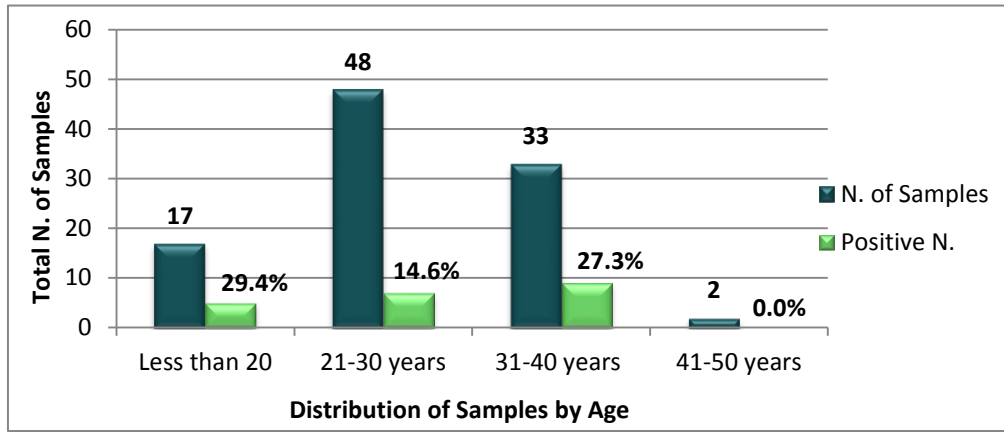


Figure (8): Prevalence of *Listeria monocytogenes* in pregnancy woman according to age in Thamar province

Table (10): Relationship between months and prevalence of *L.monocytogenes* in total human samples during period of study

Months	No, of Samples	Male Blood		Female Blood		Placenta		Total of Pos. Samples	
		N.	Pos.	N.	Pos.	N.	Pos.	N.	%
February	35	12	0	11	1	12	1	2	5.7
March	35	12	0	12	1	11	0	1	2.9
April	36	12	6	12	1	12	5	12	33.3
May	34	11	1	13	4	10	3	8	23.5
June	36	11	0	13	2	12	3	5	13.9
July	34	11	1	13	2	10	1	4	11.8
August	36	10	7	13	7	13	2	16	44.4
September	35	11	3	11	3	13	6	12	34.3
October	29	10	0	12	1	7	0	1	3.5
Total	310	100	18	110	22	100	21	61	19.7
P-value	0.001	.0620	0.004						

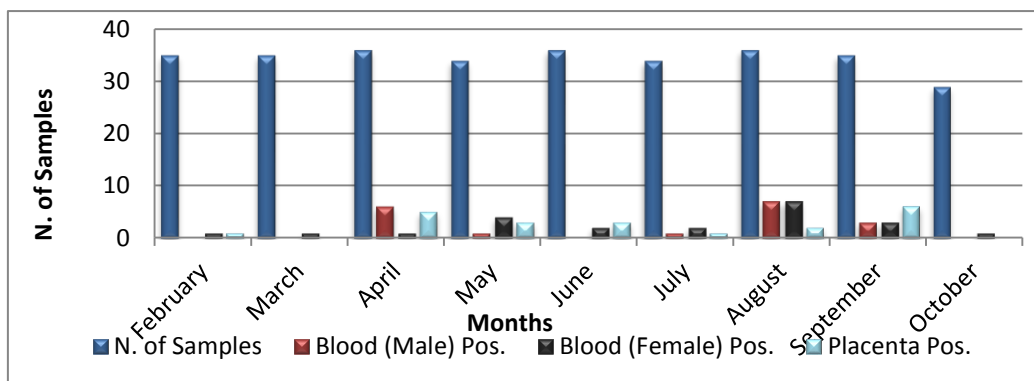


Figure (9): Relationship between months and Prevalence of *L.monocytogenes* in total human samples during period of study

Table (11): Relationship between Directorates and abortion cases in General Thamar Hospital from 2009 - 2012.

Years Months	2009	2010	2011	2012	Total
January	0	8	22	22	52
February	0	10	35	26	71
March	0	17	43	26	86
April	19	13	31	30	93
May	12	9	38	37	96
June	5	14	20	34	73
July	15	24	16	37	92
August	4	20	27	32	83
September	3	14	30	35	82
October	10	8	34	56	108
November	0	20	30	63	113
December	13	43	29	38	123
Total	81	200	355	436	1072

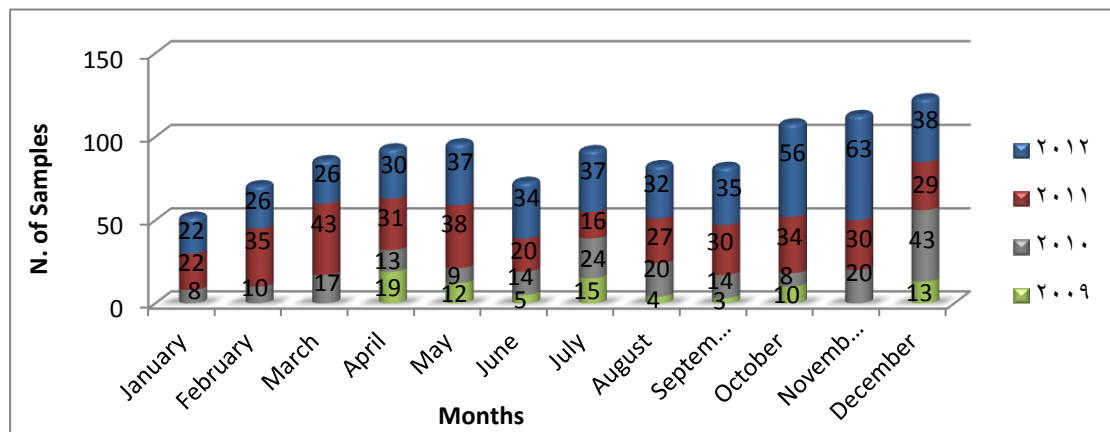


Figure (10): Relationship Between Directorates and abortion cases in General Thamar Hospital from 2009 - 2012 .

مدى انتشار بكتيريا *Listeria monocytogenes* في الإنسان في محافظة ذمار/ اليمن وذلك تبعاً للفئات العمرية المختلفة

الملخص: أجريت هذه الدراسة لتحديد مدى انتشار بكتيريا *Listeria monocytogenes* في الإنسان في محافظة ذمار/ اليمن وذلك تبعاً للفئات العمرية المختلفة.

تم جمع 310 عينة من الإنسان وواقع 100 عينة دم من الذكور، 110 عينة دم من الإناث، 100 عينة من المشيمة، حيث جمعت العينات من مستشفى ذمار العام ومستوصف المصلي والمختبرات الطبية في المحافظة.

أظهرت نتائج الدراسة بأن النسبة الكلية لانتشار بكتيريا *L. monocytogenes* من إجمالي العينات كانت 61 (19.7%)، وأن نسبة عزل البكتيريا من دم الإناث 22 (20%) كانت أعلى من دم الذكور 18 (18.0%)، وأما من المشيمة فقد بلغت 21 (21%).

كما أشارت النتائج التي تخص نسبة عزل الجرثومة من دم الإنسان حسب المديرية إلى أن نسبة العزل في الذكور كانت 11 (31.4%) في مديرية ذمار، 2 (15.4%) في مديرية جهران، 3 (10.7%) في مديرية أنس، 2 (9.1%) في مديرية الحداء، بينما لم تعزل أي عينة من مديرية عنس. كما يتضح لنا بأن نسبة العزل في الإناث كانت 10 (29.4%) في مديرية ذمار، 2 (20.0%) في مديرية عنس، 5 (17.9%) في مديرية الحداء، 2 (14.3%) في مديرية جهران، 3 (12.5%) في مديرية أنس. أما نسبة عزل الجرثومة من المشيمة حسب المديرية، فقد أشارت النتائج إلى أن أعلى نسبة لعزل الجرثومة كانت في مديرية جهران 4 (36.4%)، وتلتها مديرية الحداء 9 (33.3%)، مديرية أنس 26.3 (%). مديرية عنس 16.7 (%). ومديرية ذمار 5.4 (%). وأظهرت الدراسات الاحصائية فروق ذات دلالة معنوية عند ($p < 0.05$) بين انتشار *Listeria monocytogenes* في النساء الحوامل حسب المديرية.

وعند دراسة العلاقة بين المراحل العمرية المختلفة وبين نسبة عزل البكتيريا، وجدنا أن أعلى نسبة للعزل من دم الذكور كانت في الفئة العمرية التي تزيد عن (60) سنة بنسبة (30.0%)، وتلتها الفئة العمرية التي تتراوح ما بين (41-50) سنة بنسبة (27.3%)، ثم الفئة العمرية (31-40) سنة بنسبة (16.7%)، والفئة العمرية (21-30) سنة بنسبة (12.5%)، وأخيراً الفئة العمرية التي تقل أعمارها عن (20) سنة بنسبة (11.1%). بينما كانت أعلى نسبة عزل من دم الإناث حسب الفئات العمرية تراوحت ما بين (21-30) سنة بنسبة (27.3%)، ثم تلتها الفئات العمرية (41-50) سنة ثم الفئة العمرية التي تزيد عن (51) سنة و(31-40) سنة وأخيراً الفئة العمرية التي تقل عن (20) سنة بنسبة (25.0%)، (22.2%)، (15.8%) و (7.7%) على التوالي. وقد أوضحت النتائج أن أعلى نسبة إصابة في النساء الحوامل كانت في الفئة العمرية التي تقل عن (20) سنة بنسبة (29.4%)، وتلتها الفئة العمرية (31-40) سنة بنسبة (27.3%)، ثم (21-30) سنة وبنسبة (14.6%)، ولم تعزل أي عينة من الفئة العمرية ما بين (41-50) سنة.

أما النتائج التي تخص العلاقة ما بين نسبة انتشار البكتيريا في العينات المأخوذة من الإنسان وما بين أشهر السنة، فقد أظهرت أن أعلى نسبة كانت في شهر أغسطس وبنسبة (44.4%) وشهر سبتمبر وبنسبة (34.3%).

استنتج من هذه الدراسة أن نسبة انتشار بكتيريا *L. monocytogenes* في محافظة ذمار كانت عالية، وأن إصابة الإنسان بهذه الجرثومة يمكن أن تحدث في أية مرحلة من مراحل العمر وبخاصة المراحل المتقدمة من العمر في الذكور والمراحل التي تزداد فيها نسبة الحمل في الإناث.

أوصت الدراسة بضرورة تواصل الأبحاث والدراسات عن بكتيريا *L. monocytogenes* في مختلف محافظات الجمهورية اليمنية، والعمل على إنشاء مراكز وطنية متخصصة في مجال عزل وتشخيص هذه البكتيريا. كما أكدت على أهمية نشر التوعية الصحية عن طريق وسائل الإعلام المرئية والمسموعة والمقروءة ولكافة شرائح المجتمع من الذكور والإناث، وتسهيل الضوء على المخاطر الصحية الناتجة عن الإصابة بهذه البكتيريا، واتباع السياقات العلمية المعتمدة في مجال الصحة العامة لمنع انتقالها إلى الإنسان.