Animal Health Research Institute
Assiut Regional Laboratory

INCIDENCE OF *LISTERIA MONOCYTOGENES* IN SOME MEAT PRODUCTS AND POULTRY

(With 2 Tables)

By
AMAL A. MOHAMMED and M. M. ALI

(Received at 12/12/1998)

مدى تواجد الليستيريا مونوسيتوجين فى بعض منتجات اللحوم والدواجن

آمال أحمد محمد ، محمد مصطفى على

يعتبر مرض الليستريوزيس من أهم الأمراض التى تصيب الانسان والذى يسببه ميكروب الليستيريا مونوسيتوجين وخاصة عند تناول الأطعمة التى لاتتعرض لدرجة حرارة كافية وبسبب خطورة هذا الميكروب على صحة المستهلك أجريت هذه الدراسة لمعرفة مدى تلوث بعض منتجات اللحوم والدواجن بهذا الميكروب , لذا تم جمع عدد ١٥٠ عينة (٣٠ عينة لكل من اللحم المفروم والسجق وقطع الدجاج و ٤٠ عينة من اللنشون و ٢٠ عينة من العينات الجاهزة للأكل بواقع ١٠ عينات من كل من (الدجاج المشوى على الفحم , الكفتة المشوية على الفحم) أمكن عزل ميكروب الليستيريا مونوسيتوجين من ٩ (٣٠ %) من اللحم المفروم و ٤ (١٣,٣ %) من السجق و ١٤ (٤٦,٦ %) من الدواجن بينما لم يتم عزل الميكروب من ٤٠ عينة من اللنشون, كما أمكن عزل عترة واحدة (١٠ %) من الدجاج المشوى على الفحم بينما لم يتم عزل الميكروب من ١٠ عينات من الكفتة بعد الشوى .

SUMMARY

Listeria monocytogenes has been recognized as major foodborn pathogen especially foods which are not exposed to heat treatment. So a total of 150 samples of raw and cooked ready-to eat meat meals collected from different supermarkets and restaurants were examined for the presence of *L. monocytogenes*. Out of 30 samples of each raw ground beef, sausage and raw poultry, the positive samples were 9(30%), 4(13.3%) and 14(46.6), respectively. While the organism could not be detected in 40 samples of luncheon. In cooked ready to eat poultry meat the organism

was detected in one sample only (10%) and failed to be detected in 10 samples of grilled kofta. The source of product contamination, thermal and preservative used and public health significance were discussed.

Keywords: *Listeria Monocytogenes, Meat Poultry*

INTRODUCTION

Listeria monocytogenes has become of significant concern in recent years as a food borne pathogen (El-Kest and Marth, 1988 and Gellin et al., 1991).

Meat and meat products have frequently been found to be contaminated with *L. monocytogenes* and may serve as vehicles of this pathogenic bacterium (Elis Cherova et al., 1979; Nicholas, 1985; Breuer and Prandl, 1988; Johnson et al., 1988; Karches and Teufel, 1988 and Schmidt et al., 1988). The frequent occurrence of *L. monocytogens* and its ability to survive and proliferate at refrigeration temperatures provokes accummulation of this pathogen in contaminated meat products during cold storage and hence presents of potential risk for consumers (Doyle, 1988).

In humans the primary manifestations of listeriosis included septicemia, endocarditis, pneumonia, conjunctivitis, pharyngitis, cutaneaus papules and pustules, urethritis and meningitis (Banwart, 1989).

As *L.monocytogenes* is an ubiquitous organism, it can be shed from the intestine of both man and animals without any apparent clinical symptoms (Gracey and Collins, 1992). Therefore the presence of the organism during the processing of meat and meat products becomes unavoidable (American Meat Institute, 1988 and Lowry and Tiong, 1988). Also the post processing contamination of ready to eat meat products with Listeria spp. could be of potential hazard (Johnson et al., 1988).

Although *L. monocytogenes* has been primarily associated with dairy products it is associated also with other food of animal origin used for human consumption and has been isolated from ground beef (Nicholas, 1985 and Brakett, 1988). Nicholas and Vidaud (1987) found *L. monocytogenes* in 26% of samples of frozen minced meat samples whereas the incidence in ground beef varied from 28 % as recovered by Skovgaard and Morgen (1988) and to 58% as found by Truscott and

Mcnad (1988). Also, Farber et al. (1989 a) found that 38 of 44 (86.4 %) ground meat and 6 of 30 (20%) sausages samples contained the organism. Furthermore Fathi and Saad (1994) found that 1 of 7 (14.20 %) of sausage and zero in luncheon were contaminated by *L. monocytogenes.* Breer and Schopfer (1988) isolated *L. monocytogenes* from 18% of poultry while Jennifer et al. (1990) detected the organism in 25.6 % to 60 % of meat and meat products according to places of samples.

Therefore the present study was designed to survey the most popular meat products and poultry for the presence of *L. monocytogenes*.

MATERIAL and METHODS

(1) Collection of samples:

A total of 150 random samples of meat products including frozen ground beef, sausage, and raw poultry, (30 samples each) and 40 samples of luncheon taken from different supermarkets, as well as 20 samples of ready to eat poultry and Kofta after grilling on coal fire (10 samples each) were taken from various resturants in Assiut City. Each sample was wrapped separately and aseptically in sterile polyethylene bag, then labelled and transferred as quickly as possible to be tested bacteriologically for the presence of *L.monocytogenes*.

(2) bacteriological analysis:

25 grams of each sample were homogenized with Moulinex type blender equipped with metallic flask in 225 ml of Listeria enrichment broth (Oxoid CM 862 and Oxoid SR 141) for 1 min and incubated at 30°c for 48 h. After incubation one loopful was subcultured on Listeria selective agar (Oxoid CM 856 and Oxoid SR 140). Colonies of Listeria were visible after 24 h. at 37°c and the incubation was continued for a further 24 h. to detect slow grawing strains according to Oxoid Manual (1990).

Identification of the isolatd strains was tested according to Seeliger and Jones (1986) and Loyett (1988). Colonies were picked on tryptone soya agar incubated at 30°c for 24 h. and confirmed through Gram stain reaction, catalase, motility at 21°c in motility agar medium and Kiligar iron agar for glucose and lactose fermentation, hydrogen sulphide production, Beta haemolysis on defibrinated sheep blood agar at 37°c for 48 h. and carbohydrate fermentation (Mannitol) and nitrate reduction.

Mouse pathogenecity was performed to confirm *L. monocytogenes* according to Seeliger and Jones (1986).

RESULTS

The obtained results were tabulated in Table 1 and 2.

Table 1: Incidence of *L. monocytogenes* in some products meat and Poultry.

Meat product	No. of examined	Positive samples	
	Samples	No.	%
Ground beef	30	9	30
Sausage	30	4	13.3
Luncheon	40	-	-
Raw poultry	30	14	46.6

Table 2: Incidence of *L. monocytogenes* in ready to eat Poultry and Kofta

Cooked ready to eat	No. of examined	Positive samples	
meats	samples	No.	%
Grilled Poultry	10	1	10
Grilled Kofta	10	0	0

DISCUSSION

The results in Table (1) revealed that *L.monocytogenes* could be detected in 9(30%) of ground beef, 4(13.3%) sausage and 14(46.6%) of raw poultry, while none of the analyzed luncheon samples was found to contain *L. monocytogenes.*

Ground beef:

These results are nearly similar to those of (McClain and Lee, 1988; Schwartz et al., 1988; Skovgaard and Morgen 1988; WHO, 1988; Grau and Vanderlinde, 1992 and Elgazzar and Sallam (1997) where they could detect *L. monocytogenes* in arround (30-50%) of raw ground meat. On the other hand, high percentage of ground meat positive samples (86%) was detected by Farber et al. (1989 b) and Lee and McClain (1989) (77.3%).

The reason of such variation may be due to hygienic measures and differences in methodology.

Chicken:

The obtained high results (46.6%) lie within the range recorded by Gitter (1976), McClain and Lee (1988), Pini and Gilbert (1988) and Skovgaard and Morgen (1988) who reported the presence of the organism from 14.7 % to 60% of raw poultry. On the other hand Farber et al. (1989) which could isolate the organism from 56 % of chicken legs. The higher incidence of *L. monocytogenes* in poultry meat may be due to poultry slaughter practices which are responsible for some of this contamination and the frequent occurrence of *L. monocytogenes* in bird feces also, it has been speculated that deep litter of poultry houses may be the source (Skovgaard and Morgen, 1988).

Sausages:

The results in Table (1) show that (13.3%) of samples were positive. These results were nearly similar to those of Johnston et al. (1988) who found that 5 of 42 samples (contained *L. monocytogenes* 11.9 %). Fathi and Saad (1992) who found that 1(14.28 %) of fermented sausage were positive for *L. monocytogenes* after drying. Sausage fermentation and drying process can be regarded as means of reducing but not eliminating listeria from Sausage (Glass and Doyle, 1989 a). Higher results were recorded by Farebe et al. (1989a) who found that 6 of 30 (20%) fermented sausage contained the organism. The lowest percentage of positive samples may be due to the high susceptiblity of *L. monocytogenes* to combined chemical preservatives added to sausage (Shahamat et al. 1980, El-Shenawy and Marth 1988, and Wederquist et al., 1994).

Luncheon:

L. monocytogenes could not be detected in luncheon samples under investigation.Such result was similar to that obtained by (Fathi and Saad (1992). On the contrary, Wilson (1989) and Furrer et al. (1991) revealed the presence of such organism in 4 and 6% of the examined Luncheon samples respectively. However, the lowest percentage may be due to spices and temperature during manifacture and good hygiene.

Cooked ready to eat samples:

In ready to eat poultry, *L. monocytogenes* could be detected in 1(10%) and could not be detected in grilled Kofta (Table 2). Anon (1989) and Coote et al. (1991) found that 70°C for 2 min. cause reduction in numbers of *L. monocytogenes*. While Karaio annoglou and

Xenos (1981) could isolate *L. monocytogenes* from meat balls grilled for 15 min. at 78 - 85°C internal temperature. Kilduff (1987 a,b) and Wilson (1989) could isolate *L. monocytogenes* from about 2% (2/100) of corned beef samples. These variations may be due to that the organism could survive cooking or the poultry were contaminated after cooking (Boyle et al. 1990).

Results of monitoring program of ready to eat products in U.S.A. revealed that 5 - 12% of products sampled in (1987) and 10-13 % in 1988 were contaminated with *L. monocytogenes* (1989). Several studies occured by Glass and Doyle (1989 b) indicated that post processing contamination by *L. monocytogenes* may be a hazard.

From the above show it is important to give sufficient time during cooking, and good hand washing for food workers, good cleaning and sanitizing of the plant and elimination of product residue, using of unconventional meat product additives such as sodium lactate, nisin which act against the grawth of *L. monocytogenes*. Good manufacturing practices should decrease the incidence of Listeria.

REFERENCES

American Meat Institute (1998): Interim guid line: microbial control during production of ready to eat meats. Controling the incidence of *L. monocytogenes*. American Meat Institute Washington.

Anonymouse (1989): Chilled and Frozen: Guide lines on cook-chill and cook-Freeze Catering Systems. Department of Health, London: Her Majesty's Stationary Office.

Banwart, G.J. (1989): Basic Food Microbilogy 2nd Ed., An Avi Book, Van Nostrand Reinhold, New York. pp. 297-298.

Boyle, D.L.; Sotos, J.N. and Schmidt, G.R. (1990): Thermal destruction of *Listeria monocytogenes* in a sluny and in ground beef. Journal of Food Science. Vol.55 . 2. 327-329.

Brackett, R.E. (1988): Presence and persistance of *Listeria monocytogenes* in food and water. Food Technol. 42. 162-178.

Breer, C. and Schopfer , K. (1988): Listeria and Food . Lancet 11: 1022

Breuer, J. and Prandl, O. (1988): Nachweis Von Listerien und deren vorkommen inHackfleisch und Mettwursten in Osterrich . Aschiv Fur Lebensmittehygiene 39: 28-30.

Coote, P.J.; Holyoak, C.D. and Cole, M.B. (1991): Thermal inactivation of *Listeria monocytogenes* during a process simulating temperatures achived during micrawave heating. J. Appl. Bacteriol, 70, 489-494.

Doyle, M.P. (1988): Effect of enviromental and processing conditions on *Listeria monocytogenes*. Food Technology 42, 169 -171

Elgazzar, M.M.M. and Sallam, Kh.I.A. (1997): Occurance of *Listeria monocytogenes* and other Listeria spp. in meat products. Alex. J. Vet. Sci., 13. 4: 415 - 422.

Elischerova, K.; Stupalova, S. and Stepanek, J. (1979): Some ecological aspects of *Listeria monocytogenes* in meat industry, In problems of Listeriosis ed. Ivanov, pp. 148-155. Proceedings 7th International Symposium National Agroiondustrial Union, Sotia, Center for Scientific information.

El-Kest, S.E. and Marth, E.H. (1988): Listeria monocytogenes and its inactivation by chlorine: A review. Lebensm-Wiss. U.- Technol., 21, 346-351.

El-Shenawy, M.A. and Marth, E.H. (1988): Sodium benzoate inhibits grawth of or inactivates *Listeria monocytogenes*. J. Food Prot. 51, 525.

Farber, J.M.; Sanders, G.W. and Jonston, M.A. (1989 a): A survey of various foods for the presence of *Listeria monocytogenes* in cooked sausage products and in milk by in vitro amplication of haemolysin gene fragments. J. App. Bacteriol., 70, 372 - 379.

Farber, J. M.; Sanders, G.W. and Johnston, M.A. (1989 b): A survey of various foods for the presence of Listeria species. J. Food Prot. 52, (7) 456-458.

Fathi, Sh.M. and Saad Nagah (1992): Asurvey of some selected food items for the presence of *Listeria monocytogenes* and other listeria species. Assiut Vet. Med. J. 27, 54.

Furrer, B.; Candrian, U.; Hoefelein, Ch. and Leuethy, J. (1991): Detection and identification of *Listeria monocytogenes* in cooked sausage products and in milk by in vitro amplication of haemolysin gene fragments. J. Appl. Bacteriol., 70, 372 - 379.

Gellin, B.G.; Broome, C.V.; Bibbe,W.F.; Weaver, R.E.; Gaventa, S.; Masceola, L. and The listeriosis study Group (1991): The epidemiology of listeriosis in the United States . Am. J. Epidemiol., 133 (4), 392.

Gitter, M. (1976): Listeria monocytogenes in " oven-ready " poultry. Vet. Rec. 99 : 336.

Glass, K.A. and Doyle, M.P. (1989 a): Fate and thermal inactivation of *Listeria monocytogenes* in beaker sausage and pepperoni. J. Food Prot. 52: 226 -231.

Glass, K.A. and Doyle, M.P. (1989b): Fate of *Listeria monocytogenes* in processed meat products during refrigerated storage. Appl. Environ. Microbiol. 55: 1565-1569.

Gracey, J.F. and Collins, D.S. (1992): Meat Hygiene. 9 th Ed., Bailliere Tindall.

Grau, F.H. and Vanderlinde, P.B. (1992): Occurence, numbers, and grawth of *Listeria monocytogenes* on some vacum- packged processed meats. J. Food Prot. 55: 4-7.

Jennifer, L.; Johnson, Michael, P.; Doyle and Robert, G. (1990): Listeria monocytogenes and other Listeria spp. in meat and meat products. J. Food Prot. 53.

Johnson, J. L.; Doyle, M.P. and Cassens, R.G. (1988): Survival of *Listeria monocytogen* in ground beef. International Journal of Food Microbiolgy 6, 243-247.

Karaioannoglou, P.G. and Xenos, G.C. (1981): Survival of *Listeria monocytogenes* in meat balls. Hellenic Vet. Med. 23, 3: 111

Karches, H. and Teufel, P. (1988): Listeria monocytogenes. Vorkommen in Hackflsch und verhalten in Frischer Zwiebelmettwurst. Fleis chwirtschaft 68, 1388 - 1392.

Kilduff, P. (1987 a): Listeria found in cooked corned beef. Bulletin from Westem States Meat Association, Lean Trimmings, 615 Broadway, Oakland, CA, Nov. 23.

Kilduff, P. (1987 b): FSIS and find listeria in second plant. Bulletin from westem States Meat Association, Lean Trimmings, 1615 Broadway , Oakland , CA , Dec. 7.

Lee, W.H. and McClain, D. (1987): Personal communication. Food Safety and Inspection Sevice, U.S. Dept. of Agricultur, Beltsville, cited after Food Tchnol, April (1988).

Lovett, J. (1988): Isolation and Identification of *Listeria monocytogenes* in dairy products. J. Assoc. Off. Anal. Chem. 11: 628 - 660.

Lowry, P.D. and Tiong, I. (1988): The incidence of *L. monocytogenes* in meat and meat products: Factors affecting distribution. pp. 528-530. In proc. 34 th Int. Congress Meat Sci. Technol. Brisbane, Australia.

McClain, D. and Lee, W.H. (1988): Development of USDA-FSIS method for isolation of *Listeria monocytogenes* from raw meat and poultry. J. Assoc. off, Anal. Chem. 71: 660-684.

Nicholas, J.A. (1985): Contamination of meats and deticatessen products by *Listeria monocytogenes* in Haute - Vienna. Sci. Aliments. 5: 175 - 180.

Nicholas, J. A. and Viduad, N. (1987): Contribution L tude des Listeria presentes dans les denrees d'origione animale destinees a la consommation humaine, Rec. Med. Vet. 163, 3: 283 - 285.

Oxoid Manual (1990): Listeria species and listeriosis 6 th Ed. unipath limited, Waderoad, Basingstoke, Hamp Shire, England.

Pini, P.N. and Gilbert, R. J. (1988): The occurrence in the U. K. of Listeria species in raw chicken and soft cheese. Int. J. Food Microbiol. 6: 317 - 326.

Schmidt, V.; Seeliger, H.P.R.; Glenn, E.; Langer, B. and Leistner, L. (1988): Listerien fund in rohen, Fleischerzeugnissen. Fleis chwirtschaft 68, 1313 - 1316.

Schlech, W.F.; Lavigne, P.M.; Bortolussi, R. A.; Allen, A.C. ; Haldane, E.V.; Wort, A.J.; Hightower, A.W.; Johnoson, S.E.; King, S. H.; Nichols, E.S. and Broone (1983): Epidemic listeriosis - evidence for transmissions by food . N. Engl. J. Med. 308: 203 - 206.

Schwartz, B.; Broome, C.V.; Brawn, G.R.; Hightower, A.W.; Ciesielski, C. A.; Gaventa, S.; Gellin, B.G. and Moscola, L. (1988): Association of sporadic listeriosis with consumption of uncooked hot dogs and under cooked chicken Lancet 57: 779 - 782.

Seeliger, H.P.R. and Jones, D. (1986): Genus listeria pirie in: Bergey's Manual of Systematic Bacteriology, 2 ed. sneath P.H.A., Mair N.S. Sharpe M.E., and Holt J. G. pp. 1235 -1245. Baltimore: Williams & Wilkins Co.

Shahamat, M.; Seaman, A. and Woodbine, M. (1980): Influence of sodium chloride, pH and temperature on the inhibitory activity of sodium nitrite on *Listeria monocytogen*, " In Microbial growth and Survival in Extremes of Environment " ed. Gould G. W. and Corry. J. E. L., P. 227 Academic press, London.

Skovgard, N. and Morgen, C.A. (1988): Detection Of Listeria spp. in feces from animals, in feeds, and in raw foods of animal origin , Int. J. Food Micrbiol. 6: 229 - 229 - 242.

Truscott, R.B and Mcnab, W.B. (1988): Comparison of media and procedures for the isolation of *Listeria monocytogenes* from ground beef. J. Food Prot. 51: 626 - 628.

Wederquist, H.J.; Sofos, J.N. and Schmidt G.R. (1994): *Listeria monocytogenes* in refrigerated vacum packaged turkey bologna by Chemical additives. J. Food Science, 59, 3, 498.

WHO (1988): Food borne Listeriosis. WHO / EHE / FOS / 88.5.

Wilson, G.D. (1989): *Listeria monocytogenes* 1988, P. 11-13 in Proc.Reciprocol Meat Conference, Vol. 41. National livestock and Meat Board. Chicago, IL.