EFFECT OF DEEP AND SURFACE FRYING AND MICROWAVE COOKING ON *LISTERIA MONOCYTOGENES* FOUND IN HOT DOGS

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Abstract

Over the last several years *Listeria monocytogenes* had become an important foodborne pathogen which could grow at the refrigeator temperature below -0.4°C and also at the high temperature. 50°C. This microorganism can grow in meat and fish products and cause many serious epidimic diseases such as listeriosis.

Samples representing long (23x 2.6 cc) and short (11x 2.1 cc) hot dogs were examined for total plate counts and *l.monocytogenes* counts over a period of four weeks. After deep and surface frying and microwave cooking, microbiological collected from McBride Agar medium was carried out to make sure that the strains belonged to *l.monocytogenes* and were hoemolytic pathogenic listeria.

Data showed that microwave cooking was dangerous due to the surface frying. Deep frying however destroyed all the counts of *l.monocytogenes.*

The results indicated that much care should be given to the hygienic conditions in sausage plants. In variable from week to week; ranging among the weeks from 352% to 671% before and after cooking respectively. The respective percentages for listeria were 227 and 167%.

INTRODUCTION

Schwartz *et al* (1988) found that cooked poultry and hot dogs were associated with listeriosis. They repored that 20% of the overall risk of listeriosis was attributable to these two foods. Barnes *et al.* (1989) and linked a case of listeriosis to

turkey franks. They detected more than 1100 organisms / gm.

L.monocytogenes can grow under conditions different than suitable for other pathogenes since it can grow between -0.4 and 50C (Junttila et al., 1988; Walker and Stringer, 1987).

The heat resistance of *L.monocytogenes* in meat and meat products is shown in Table 1.

Table 1. Heat resistance of *L.monocytogenes* in meat and processed meat

Product	Temp. (C°)	D value	Z value	Reference
Beaf	60	3.8	7.2	Mackey *et al.* (1990)
Ground beef	70	0.14	5.3	Farber *et al.* (1990)
Beefsteak	60	3.12	5.98,5.98	Gaze *et al.* (1989)
Liver saus-	60	8.32,6.27		
age	70	0.20,0.14		
Slurry	60	2.42	6.2	Bhaduri *et al.* (1991)

Mackey *et al.* (1990) and Farber *et al* (1990) found that although the addition of beef fat does not appear to enhance heat resistance of *L.monocytogenes*, the presence of curing salt substantially increased it.

Blanco *et al.* (1989) recommonded the addition of red cells top layer to modified mcBride agar to identify haemolytic pathogenic listeria.

The purpose of the present investigation is to study the effect of deep and surface frying and microwave cooking on *Listeria monocytogenes* found in hot dogs.

MATERIALS AND METHODS

Thirty two samples representing long hot dogs (23 x 2.6 cc) and short hot dogs (11x 1.9 cc) were purchased from different supermarkets in Cairo during a period of four weeks. These samples were examined for total plate count and L.mocytogenes counts before and after heat treatments. The heat treatments includ-

ed Surface and deep fat frying and microwave cooking. Isolates of *L.monocytogenes* were then collected from McBride Agar for simple identification to make sure that these strains belonged to *L.monocytogenes.*

Deep and surface frying was done in corn oil. Microwave cooking was done in a done microwave oven without oil. In all cases cooking was carried out until the colour of the pieces changed to brown and casings began to rent.

Surface frying was done until the temperture inside the finger reached 74C (after 10 mimtes), while it was 78C (after 5 minutes in deep fat frying. The temperature of microwave samples was 79C (after one minute).

Twenty grams samples were homogenized in 180 ml of 0.1% peptone water for 2 min in a sterile blender jar . Total plate counts were undertaken on standard plate count agar (A.P.H.A., 1971) and incubated at 32C for 48h. L.monocytogenes was counted on modified McBride Agar then incubated at 30C according to Lee and McClain (1986).

Putrification of the strains collected from the plates of modified McBride Agar before and after the cooking treatments was carried out. The putrifation was made on modified McBride Agar. The cultural characteristics were the observed on the same plates. Thereafter the following tests were conducted for rapid identification of L. monocytogenes strain as indicated by victor (1990) :

1- Sugar acidification : Acid production from rhaminose, Xylose, D-galactose, manitol and glucose was detected by an agar plate method; 1% from a filter - sterilized sugar stock solution was added to purple agar base (Difico) medium.

2-Hoemolytic activity was carried out on washed sheep blood agar (5% v/v) incubated at 35C for 24-48 h.

3- KOH contrast microscopy for cell morphology and motility .

5- Catalase test was made by adding 1 drop of 3% H2 O2 to the cell suspension.

RESULTS AND DISCUSSION

Table 2. indicates a pronounced bacterial counts for the two kinds of hot dogs. before heat treatments. The total bacterial counts were more than 106. The L.monocytogenes counts which were up to 10^3 showed a similar trend. This was in agreement with the findings of Schwartz *et al.* (1989). The similar exponent value of the counts could be attributed to the fact that the two types of hot dogs belonged to one factory although bacterial densities differed for the two sausages.

Deep frying treatment exhibited the lowest total bacterial counts among the other heat treatments.

With regard to the presence of *L.monocytogenes* after heat treatments, deep frying destroyed all *L.monocytogenes*. This might be correlated to the high temperature which reached 78C inside the finger, thus showing the advantage of this treatment over the others the worst heat treatment was that of the microwave since the counts of *L.monocytogenes* after cooking remained fairly high (1x 10^3 and more).

Short hot dogs showed low total bacterial counts *L.monocytogenes* and counts after the heat treatments.

Although the count of *L.monocytogenes* after surface frying was lower than that of microwave treatment, the samples still retained counts of about twice 10^1. Thefefore, surface frying might lead to serious problem.

The rapid scheme of identification (Table 3) indicated that the medium used was so specified in counting the hoemolytic pathogen *L.monocytogenes* since all the isolates acturally belonged to *L.monocytogenes* .

It is clear that the choice of heat treatment is very important in cooking meat products. This is extremely important because the survival of *L.monocytogenes* at high temperatures (Tables 2 and 3). Such microoganism should be eliminated during meat processing as well.

A marked differnce in bacerial load from week to week was obsersed in the

Table 2 . Frying, deep frying and cooking in microwave oven (oount / gm).

Types Intervais	Detection of	Long Beef hot dogs 23 x 2.6 cc	Short Hot dog 11 x 2.1 cc
	A. Before heat treatment :		
1*st* week	Total Plate counts	6×10^6	3.75×10^6
	L.monocytogenes	4.8×10^3	6.4×10^3
2*nd* week	Total Plate counts	14×10^6	2.31×10^6
	L.monocytogenes	6.30×10^3	4.2×10^3
3*rd* week	Total Plate counts	11×10^6	1.68×10^6
	L.monocytogenes	5.2×10^3	2.81×10^3
4*th* week	Total Plate counts	13.2×10^6	7.6×10^6
	L.monocytogenes	5.90×10^3	9.2×10^3
	B.after gurface frying		
1*st* week	Total Plate counts	26	12
	L.monocytogenes	20	6
2*nd* week	Total Plate counts	36	9
	L.monocytogenes	20	5
3*rd* week	Total Plate counts	30	7
	L.monocytogenes	20	31
4*th* week	Total Plate counts	34	8
	L.monocytogenes	18	
	C. After deep fryings:		
1*st* week	Total Plate counts	10	5.0
	L.monocytogenes	Zero	0.0

Table 2. (Con.)

Types Intervais	Detection of	Tall Beef hot dogs 23 x 2.6 cc	Short Mot dorg 11 x 2.1 cc
			7.0
2*nd* week	Total Plate counts	29	0.0
	L.monocytogenes	Zero	4.0
3*rd* week	Total Plate counts	15	0.0
	L.monocytogenes	Zero	14.0
4*th* week	Total Plate counts	23	0.0
	L.monocytogenes	Zero	
	D. After Micrownve cooking :		
1*st* week	Total Plate counts	$3x10^3$	3.6×10^3
	L.monocytogenes	$1x10^3$	1.4 x 10
2*nd* week	Total Plate counts	0.3×10^3	2.8×10^3
	L.monocytogenes	1.5×10^3	1.8×10^3
3*rd* week	Total Plate counts	4×10^3	8.3×10^2
	L.monocytogenes	1.1×10^3	3.1×10^2
4*th* week	Total Plate counts		6.4×10^3
	L.monocytogenes		4.1×10^3

same sausage plant. For insance, for long and short sausages, the differences between highest and lowest total bacterial (expressed by lowest contamination %) were counts 133%, 352% before cooking, 39% and 86% for shallow (Surface frying, 130% and 250% for deep frying and 40% and 671% for microwave cooking. The Listeria values were : 31% and 227% before cooking, 31% and 167% for surface frying and 50% and 128% for microwave cooking, respectively. This show the lack of adequate hygienic conditions in the supermarkets as expressed by the remarkable difference in pollution levels of raw materials.

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تأثير التحمير السحى والعميق والطهى بالميكروويف على ميكروبا لليستريا مونو مستوجينس الموجود بالهوت دوجز

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أستهدفت هذه الدراسه معرفه تأثير أكثر المعاملات الحرارية شيوعا وهى التحمير على منتجات اللحوم من نوع الهوت دوجز. ولقد أجرى تحمير سطحى وتحمير عميق وتحمير بالميكروويف، وتم متابعة الأعداد الكلية بالاضافه الى أعداد ميكروب الليستريا مونوستوجنيس وقدرت هذه الأعداد فى الهوت دوجز المتحصل عيه من مصادر مختلفه على مدى أربعه اسابيع قبل التحمير وكذلك تم تقدير هذه الاعداد على نفس العينات بعد التحمير وكان الهوت الدوج المتحصل عليه من النوع القصير (١١ x ١,٩) والنوع الطويل (٢٣ x ١,٦). وصنفت عينات السلالات المتحصل عليها من اليستريا مونوسيتوچينس للتأكد من أن الاعداد المتحصل عليها تنتمى لهذا الميكروب . وإظهرت النتائج أن أحسن المعاملات هى التحمير العميق بينما كان أسواها التحمير بالميكروب الذى ظلت أعداد الميكروب بعده مرتفعة. ولقد أعطى التحمير السطحى أعداد قليلة من هذا الميكروب. ولخطورة هذا الميكروب أوصت الدراسة بضرورة إختيار طريقة التحمير التى تقضى على هذا الميكروب وهى التحمير العميق.