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INHIBITORY EFFECT OF SOME ANTIBACTERIAL AND HEAT TREATMENTS ON *LISTERIA* *MONOCYTOGENES* IN VACUUM PACKED CHICKEN LUNCHEON SLICES

(With 3 Figures)

By

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التأثير المثبط لبعض مضادات البكتريا والمعالجات الحرارية علي ميكروب
الليستريا مونوسيتوجين بشرائح لانشون الدواجن المعبأة تحت التفريغ

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لقد تم استخدام طريقتان للتحكم في ميكروب الليستريا مونوسيتوجين في لانشون الدواجن المعبأة تحت تفريغ المعدة للبيع المعالجة الاولي اجريت بحقن ميكروب الليستريا مونوسيتوجين بتركيز 10⁷ خلية / جرام في شرائح اللانشون ثم غمرت في 5% حمض خليك - 5% خلات صوديوم و 5% خليط من المحلولين. تم تعبئة شرائح اللانشون المحقونة والغير محقونة (ضابطة) تحت تفريغ وتخزينها عند 4° م و 10° م وفحصها علي فترات لمدة 30 يوم. وأظهرت النتائج ان استخدام خليط من المحلولين كان له تأثير مسبط علي الميكروب بعد 25 و 30 يوم من التخزين. المعالجة الثانية اجريت بتسخين الشرائح المعبأة تحت تفريغ في حمام مائي عند 80° م لمدة 0.5، 1، 3، 5 و 7 دقائق وقد لوحظ أن زيادة المدة المحددة للتسخين يؤدي الي زيادة نسبة موت الليستريا مونوسيتوجين.

SUMMARY

Two treatments were used to control *L. monocytogenes* on commercial vacuum packaged chicken luncheon. The first treatment was carried out by inoculated *L. monocytogenes* strain (10⁷ cfu/g) on luncheon slices, then dipped in acetic acid 5%, sodium diacetate 5% and their combination. The inoculated and non inoculated (control) vacuum packaged slices were stored at 4°C and 10°C and examined interally up to 30 days. Listericidal effects were observed for the combination of the two antimicrobial tested at days 25 and 30 days of storage. The second treatment was carried out by heating the vacuum packaged slices in a water bath at 80°C for interval periods 0.5, 1, 3, 5 and 7 minutes. Increasing heat treatment time led to increase the lethality for *L. monocytogenes*.

Key words: *L. monocytogenes*, chicken luncheon, acetic acid, disodium acetate

INTRODUCTION

L. monocytogenes is a pathogenic bacterium found in soil, water and on the surface of equipment, floors, and walls. About 99% of reported listeriosis cases were transmitted by foods (U.S. Department of Agriculture, Food Safety and Inspection Service (2003). *L. monocytogenes* is ubiquitous, can be resistant to many food preservation methods (Lou and Yousef., 1991). It has the ability to colonize meat plants (Samelis and Metaxopoulos, 1999). It survives under favorable conditions (Harmayani *et al.* 1993).

Numerous sporadic and outbreak cases of foodborne illness has been linked to consumption of ready to eat (RTE) products contaminated with *L. monocytogenes*. Recontamination may occur after cooking (postcooking contamination) by peeling, slicing and repackaging (U.S. Food Safty and Inspection Service, 2003). Although luncheon meat slices (ready to eat meat products) contain salts such as sodium chloride, nitrite and nitrate, they don't inhibit the growth of *Listeria* during storage at refrigerated temperatures (Mbandi and Shelef, 2002).

Because of irradiation is not approved for use on packaged ready to eat products, interest in the incorporation of generally recognized as safe chemical or biological antimicrobial compounds (El-Shenawy and Marth, 1989; Schmidt, 1995; Wederquist *et al.* 1995; Blom *et al.*, 1997) as safety barriers has been renewed (Kuntz, 1999).

Antimicrobial agents have been shown to be valuable in the effort to control *L. monocytogenes* in RTE meat as additives in the formulation of various products, or post processing application. The post processing application of antimicrobial by dipping is more advantageous than their addition in the formulation (Barmpalia *et al* 2004; Geornarsa *et al* 2005).

Post process contamination also may occur in the consumer's refrigerator, even on foods that may not be reheated before consumption. So several studies have evaluated post cook pasteurization to eradicate *Listeria* on fully cooked meat.

Post processing application of antimicrobial and post packaging thermal pasteurization may enhance protection against post processing contamination with *L. monocytogenes* in luncheon meat slices (Farber and Peterkin 1999; Tompkin *et al* 1999).

The objectives of this study were to investigate the antilisterial effect of some chemical agents applied on surface of commercial luncheon vacuum packaged meat slices inoculated after processing and

stored in vacuum packages at 4°C and 10°C. Storage temperature represent potential mild abuse during distribution and retail as well as at the consumer level and also to validate antilisteiral effectiveness of hot water pasteurization post packaging of the same product.

MATERIALS and METHODS

Bacterial culture (inoculum)

The cultures of *Listeria monocytogenes* was maintained on brain heart infusion (BHI) slants. Loopfull from BHI slants was inoculated into BHI broth and inoculated over night at 35°C. Serial dilutions of the fresh culture was carried out in 0.1% peptone water to obtain a target level of 7 log cfu/cm² when 0.1 ml of inoculum was applied to each side of luncheon slice.

Product inoculation

Vacuum packages luncheon slices were obtained from a local supermarket in retail packages, each contain six slices were used in this study: Each retail package of luncheon was aseptically peeled, opened in a laminar flow hood. The slices were placed on aluminum foil. Inoculum of 0.1 ml of *L. monocytogenes* was spread over one side of each slice with sterile bent glass rod, left to stand for 15 minutes to allow for inoculum attachment. The same procedure was repeated for the other side of each slice. Following the inoculation, slices were treated as follows;

1- Treatment 1:

Each inoculated slice was transferred from the aluminum foil with sterile forceps and immersed in different sterile antimicrobial in distilled water for 2 minutes and in water alone. The dipping solutions were (% wt/vol) as follows:

- 1- Acetic acid (A.A) 5%
- 2- Sodium diacetate (Na Diacetate) 5%
- 3- Combination of 1 and 2 in equal volumes
- 4- Distilled water (control)

After application of the chemical treatments and water slices were drained 1 minute. They (per sample) were stacked on top of each other and were inserted into a vacuum bag, vacuum packaged and stored at 4°C and 10°C for up up 30 days. Duplicate samples were prepared for each treatment; all treatments were microbiologically analyzed immediately after inoculation on day 0 and at 5, 10, 15, 20, 25 and 30 of storage.

2- Treatment 2:

The inoculated luncheon slices were vacuum packaged then treated by submersion in a thermostatically controlled water bath at 80°C for 0.5, 1, 3, 5, 7 and 10 minutes. Samples were removed from the heated water bath, cooled immediately in an ice water bath. All packages were stored at 4°C for up to 3 h until microbiological analysis.

Microbial enumeration of *Listeria monocytogenes*

Each package was wiped with 75% ethanol and aseptically opened, 25 gm of the luncheon slices were transferred into sterile stomacher bag then 225 ml of buffered peptone water (Difco) were added. The contents were mixed for 1 min. Serial dilutions were made in buffered peptone water and plated in duplicate on modified oxford agar. Colonies were enumerated after incubation at 37°C for 24-48 h. To obtain preliminary information on *Listeria monocytogenes* population associated with the samples, random representative samples were used for enumeration of *L. monocytogenes*.

RESULTS

The effects of some antibacterial agents namely acetic acid 5%, sodium diacetate 5% and their combination as well as heat treatment on the growth and survival of *Listeria monocytogenes* in vaccum packaged chicken luncheon are presented in Figures 1-3.

Fig (1): Effect of AA, NaDia and combination of both on *L. monocytogenes* population inoculated on vacuum packaged chicken luncheon slices stored at 4 °C

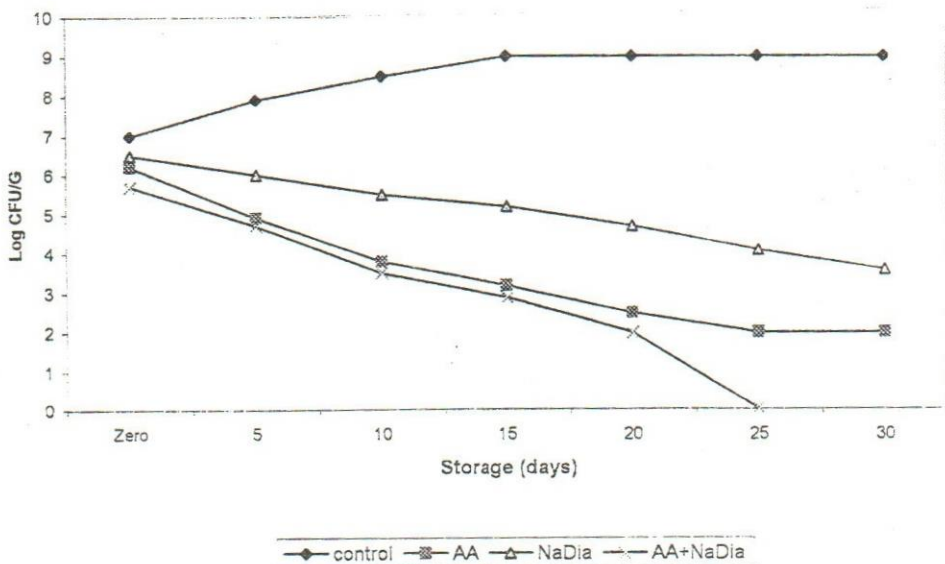


Fig (2): Effect of AA, NaDia and combination of both on *L. monocytogenes* population inoculated on vacuum packaged chicken luncheon slices stored at 10 oC

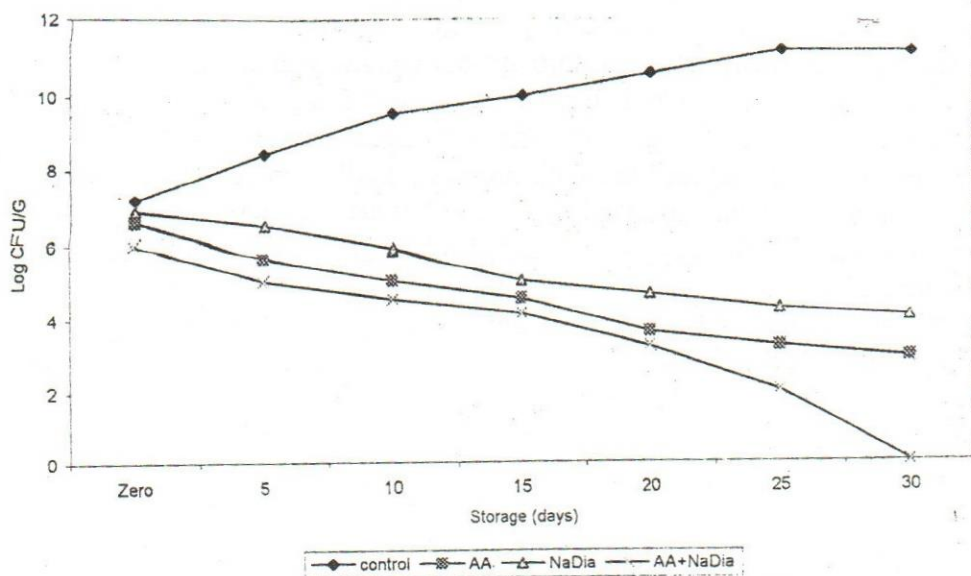
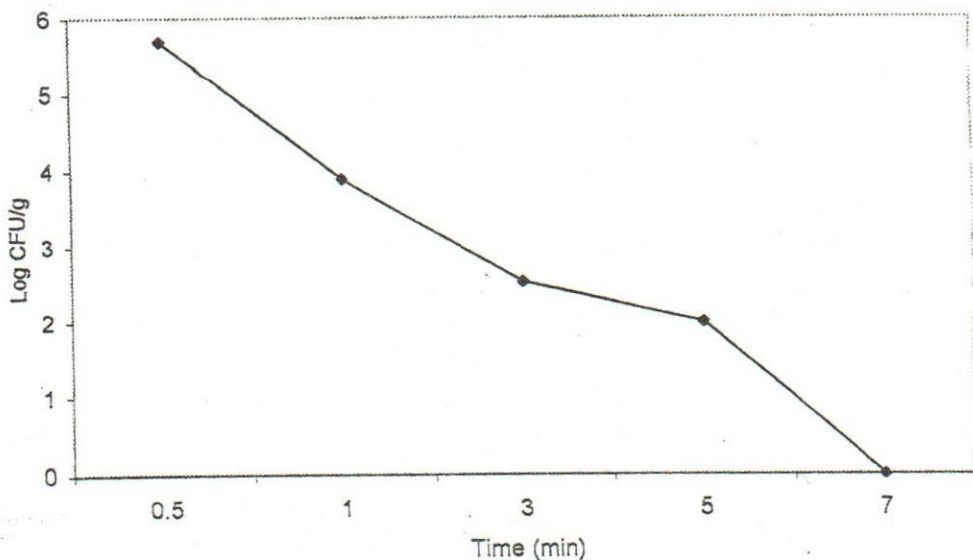


Fig (3): Effect of pasturization on *L. monocytogenes* population inoculated on vacuum packaged chicken luncheon slices



to 5 kg of defat turkey product in 189 liters of 93.3°C water always resulted in a 2 log reduction of *L. monocytogenes* count.

From this study it can be concluded that post package (pp) contamination of vacuum packaged luncheon slices with *L. monocytogenes* is an important safety concern and emphasize the hot water pasteurization step after packaging or the antimicrobial solutions to control or reduce the growth of the pathogen, our results show that PPP treatment of the vacuum packaged luncheon cause reduction of the *L. monocytogenes* and was affected by treatment time and the treatment with the exposure or dipping in antimicrobial solutions acetic acid (A.A), sodium diacetate and combination of them before vacuum packaging control the growth of *L. monocytogenes* even at abusive storage temp.

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