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SENSITIVITY OF LISTERIA MONOCYTOGENES TO SOME SELECTED SPICES

(With Two Tables)

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حساسية الليستيريا مونوسيتوجين لبعض التوابـــــــــــــــــل

يحـــيى حفنـــــــاوى

تم دراسة تأثير بعض التوابل الخام أو الطبيعية والمستخدمة في تصنيع منتجات اللحـــوم والتى شملت البهار ، الساغو ، التابل ، جوزة الطيب ، الفلفل الأسود ، الفلفل الأبيض ، الفلفل الأرناوطى ، الكمون ، الفلفل الأحمر ومسحوق الثوم على نمو عترتان من الليستيريا مونوستيوجين هما V7 Scott A في وسط سائل يحتوى على ٣ تركيزات مختلفة من التوابـــــل هى ١٪ ، ٣٪ ، ٥٪ . وجد أن عترة Scott A حساسة لكل تركيزات التوابل المختلفـة والمستخدمة ماعدا الفلفل الأبيض فلم يكن له أى تأثير كما وجد أن تركيز ٥٪ من البهـــار التابل ، جوزة الطيب ، الفلفل الارناوطى والساغو له تأثير فعال على عترة V7 وقد تبين من الدراسة أن كل تركيزات الساغو المختلفة وهى ١٪ ، ٣٪ ، ٥٪ لها تأثير فعال على عترتـين الليستيريا اللتين تم إختبارهما . وقد لوحظ وجود إختلاف في مدى حساسية عترتان الليستريـا للتوابل المختلفة ولقد ثبت أن عترة Scott A أكثر حساسية للتوابل المستخدمة فـــــي منتجات اللحوم من عترة V7 كما تم مناقشة أهمية وكذا نوع التوابل المستخدمة في تصنيـع منتجات اللحوم على حيوية بعض الميكروبات المحتمل تواجدها في هذه المنتجات وخاصـــــة الليستيريـــا .

SUMMARY

The effect of some natural spices as allspice, sage, mace, nutmeg, black pepper, white pepper, paprika, cumin, red pepper and garlic powder on the growth of two Listeria monocytogenes strains V_7 and Scot A in liquid medium has been investigated. At all spice concentrations, strain Scott A was sensitive to all the spices tested except white pepper. The growth of strain V_7 was inhibited by allspice, mace, nutmeg, paprika and sage at level 5%. Sage was the most efective one where the two Listeria strains were sensitive to all the concentrations used. Strain V_7 was more resistant than Scott A to the inhibitory effectrs of spices used in meat food products.

INTRODUCTION

Spices and herbs are used in foods today mainly for their flavour and odour. The flavour components consist of such compounds as alcohols, aldehydes, esters, terpenes, phenols, organic acids and others, some of which have not yet been fully identified. In the United states spice consumption is around 500 million pounds per year (HANNIGAN, 1980), about 20% of spices are used in the meat industry (WEISER, et al. 1971). Each amounts and kinds of spice used will vary with the product and its manufacture. However, the list of spices used in meat food products would include most known spices and the following is a partial list of those used: allspice, anise, basil, paprika, pepper, sage, thyme, mustard, nutmeg, mace, trumeric, sweet bay, carawy, cardmon, cassia, cayenne, celery seed, chives, cinnamon, cloves, coriander, dill, garlic, ginger and marjoram (LIBBY, 1975).

Some spices stimulated microbial activity (FRAZIER and WESTHOF, 1978; ZAIKA, et al. 1978; ZAIKA and KISSINGER' 1981), others exhibit antibacterialaction as cloves, mustard seed, garlic, onion and oregano (BULLERMAN, et al. 1977; SHELEF, et al. 1980). Studies in the early century described inhibitory properties of volatile compounds and their effect on a variety of microorganisms. Reports have become sporadic with the wide spread use of modern preservation techniques, but a renewed interest in the antimicrobial activities of spices is seen in the last decade. It is recognized now that spices and herbs may fulfill more than one function in foods to which they are added. In addition to imparting flavour, certain spices prolong the storage life of foods by a bacteriostatic or bactericidal activity, and some prevent rancidity by their antioxidant activity as cloves, cinnamon, sage, rosemary, mace, oregano, allspice and nutmeg (SHELEF, et al. 1980; ZAIKA and KISSINGER, 1981).

Studies have been reported on the effect of garlic and onion (JOHNSON and VAUGHN, 1969), allspice, cassia, oregano and onion (JULSETH and DEIBEL, 1974), cinnamon (BULLERMAN, 1974), nutmeg, curry, mustard, black pepper, thyme and oregano (BEUCHAT' 1976), sage, rosemary, and allspice (SHELEF, et al. 1980) on various food-borne organisms including S. typhimurium, E. coli, V. parahaemolyticus, some gram - negative and gram-positive bacteria. Others described the effects of essential oils, spice extracts, and pepper on the keeping quality and microflora of sausage products (MORI, et al. 1974).

The present work deals with the sensitivity of Listeria monocytogenes to some natural spices in liquid medium.

MATERIAL and METHODS

Spices:

Finely ground allspice, sage, mace, nutmeg, black pepper, white pepper, paprika, cumin, red pepper, and garlic powder were employed in the study.

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Microorganisms:

Two Listeria monocytogenes strains V_7 (serotype 1) and Scott A (serotype 4 b) were tested.

Growth and survival of Listeria monocytogenes in liquid medium:

Flasks containing 100 ml of sterile Tryptose broth TB (Difco) with spices levels 1, 3 and 5% were inoculated with 24-48 hours Listeria culture to give an initial bacterial population in the range of 10^4-10^5 cells/ml for flasks containing spices as well as the control without spices. The flasks were inoculated statically for up 7 days at 4°C. Growth was determined by serial dilutions in sterile 0.1% peptone water and plating in Trypaflavine-Naldixic Acid Serum Agar (TNSA) plates (RALOVICH, et al. 1971) which were incubated at 35°C and colonies were counted after 48 hours.

RESULTS

The response of Listeria monocytogenes strain V_7 to various concentrations of ten defferent spices used in meat food products is shown in Table (1). In the absence of spices cell numbers increased to a log CFU of 9.32 which raised to a log of 13.51 after 7 days.

Allspice, sage, mace, nutmeg and paprika exhibited antibacterial action, whereas black pepper, cumin, garlic powder, red pepper and white pepper stimulated microbial activity. However, increasing concentrations of spices delayed bacterial growth.

Regarding sage, the three concentrations used were sufficient to inhibit completely growth of Listeria monocytogenes V_7 after 4 days.

The effect of various concentrations of different spices used on Listeria monocytogenes Scott A is shown in Table (2). This organism was more sensitive than strain V_7.

The most effective spice was sage followed by allspice where no surviving cells showed after 24 hours in the presence of all concentrations. Cumin, garlic powder, paprika and red pepper inhibited Listeria growth after 4 days. However, white pepper has no effect on strain Scott A.

DISCUSSION

Two strains of Listeria monocytogenes were tested for their response to natural spices in a liquid medium. Of the ten spices examined for antibacterial activity, sage was the msot effective one in all tests conducted followed by allspice.

Sage and rosemary and a combination of them were found to affect the growth of gram-positive and gram-negative bacteria where gram-positive were more sensitive to the spices than gram-negative and enteropathogenic gram-positive bacteria such as B. cereus and coagulase-positive S. aureus were particularly sensitive (SHELEF, et

al. 1980). JULSETH and DEIBEL (1974) found that the growth of Salmonella inoculated into pre-enrichment media containing oregano was definitely inhibited while others reported that oregano was highly toxic to Vibrio parahaemolyticus when present in growth media at a concentration of 0.5% (BEUCHAT, 1976). Further, increasing concentrations of oregano from 0.5 to 8 gm/litre in a liquid medium resulted in stimulation, delay or inhibition of acid production and viability of Lactobacillus plantarum and Pediococcus cerevisiae (ZAIKA and KISSINGER, 1981).

The results of this investigation indicate that Listeria monocytogenes may be inhibited by some spices particularly sage and allspice which added to foods at refrigeration temperature (4°C).

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Table (1)

Growth of Listeria morocytogenes strain V_7 in TB containing 0, 2, 3 and 5% spices at 4°C

Incubation time (days)	Spice concentration	Spices									
		Allspice	Black pepper	Cumin	Garlic powder	Mace	Nutmeg	Paprika	Red pepper	Sage	White pepper
		Log**	Log	Log	Log	Log	Log	Log	Log		
0		7.1	7.1	7.1	7.1	7.1	7.1	7.1	7.1	7.1	7.1
1	C* 0	9.32	9.32	9.32	9.32	9.32	9.32	9.32	9.32	9.32	9.32
	1%	8.22	8.6	8.47	8.27	8.25	8.45	9.4	9.44	9.54	9.42
	3%	6.93	7.24	7.07	7.17	6.58	7.05	7.27	7.13	7.04	8.06
	5%	4.83	7.06	6.56	7.3	6.23	6.75	7.07	6.86	3.90	7.38
4	C 0	12.47	12.47	12.47	12.47	12.47	12.47	12.47	12.47	12.47	12.47
	1%	8.39	11.05	9.17	9.13	8.79	8.53	9.26	12.06	2.30	11.08
	3%	4.87	7.34	9.29	7.09	6.04	6.20	4.34	8.59	0	9.33
	5%	3.39	7.34	6.57	7.03	5.60	6.11	6.81	7.16	0	7.34
7	C 0	13.51	13.51	13.51	13.51	13.51	13.51	13.51	13.51	13.51	13.51
	C%	6.91	11.08	11.39	11.07	9.19	7.04	10.93	12.89	0	10.94
	3%	3.84	9.25	9.08	9.34	4.73	4.99	8.39	9.36	0	9.45
	5%	2.30	8.91	8.96	9.25	4.34	4.72	6.69	9.14	0	7.47

* Control (without spices).

** Log.

Table (2)

Growth of Listeria monocytogenes strain Scott A in TB containing 0, 1, 3 and 5% spices at 4°C

Incubation time (days)	Spice concent-ration	Spices									
		Allspice	Black pepper	Cumin	Garlic powder	Mace	Nutmeg	Paprika	Red pepper	Sage	White pepper
0	5	5	5	5	5	5	5	5	5	5	5
1	C*	6.08	6.08	6.08	6.08	6.08	6.08	6.08	6.08	6.08	6.08
	1%	2.3	5	4.15	4.85	5.09	5.07	3.85	3.73	0	4.76
	3%	0	4.96	3.81	3.65	4.88	4.99	2.09	3.48	0	4.57
	5%	0	4.56	3.52	2.48	3	3.58	0	2.3	0	4.58
4	C	8.73	8.73	8.73	8.73	8.73	8.73	8.73	8.73	8.73	8.73
	1%	0	3.78	3	3	5.90	6.48	3	3.48	0	6.61
	3%	0	3.6	0	0	3.85	4.54	0	0	0	5.9
	5%	0	0	0	0	2	3	0	0	0	4.81
7	C	10.99	10.99	10.99	10.99	10.99	10.99	10.99	10.99	10.99	10.99
	1%	0	3.18	0	0	4.39	6.08	0	0	0	8.25
	3%	0	2	0	0	2.69	3.32	0	0	0	7.59
	5%	0	0	0	0	0	2	0	0	0	5.67

* Control (Without spices).