

EFFECT OF POTASSIUM SORBATE AND *NIGELLA SATIVA* ON THE GROWTH AND SURVIVAL OF *Y. ENTEROCOLITICA* INOCULATED INTO MINCED MEAT

Fathi Sh.¹, Hefnawy Y.¹, Sabah Moustafa², Abd El-Malek A.²

¹Dept. of Meat Hygiene, Fac. of Vet. Medicine, Assiut Univ., Assiut – Egypt.

²Animal Health Research Institute, Assiut, Egypt.

Background

Potassium sorbate is used widely throughout the world as preservative for various foods, animal feeds and other industrial application (Sofos and Busta, 1989). It has been used extensively as chemical preservative to control psychrotrophic organisms (e.g. *Y. enterocolitica*) in chilled foods (Tsay and Chou, 1989; Moir and Eyles, 1992). *Nigella sativa* (black cumin or black seeds) has been used over many countries in the Middle East and Far East as a natural remedy for a wide variety of human diseases due to its antibacterial action and immune enhancing effect (Mahdi, 1993). Seed extract of *N. sativa* has a good antibacterial activity beside a therapeutic potential for the treatment of some Gram-negative bacterial infection (Ferdous et al., 1993). The aqueous extract of *N. sativa* possessed antibacterial activity in higher concentration, also all fractions of both *Zinger officinale* and *N. sativa* exhibited antimicrobial activities against various microorganisms (Kandil et al., 1994).

Objectives

A research has been conducted to study the effect of Pot. sorbate (0.1 and 0.2%) and 1 and 3% of ground black seeds (*N. sativa*) on the growth and survival of two strains of *Y. enterocolitica*, American serotype 0:8 and European serotype 0:9 inoculated into minced meat.

Methods

The cultures of *Y. enterocolitica* used in this study included the strain 1835 serotype 0:8 obtained from the Food Research Institute, University of Wisconsin, Madison, USA, other virulent *Y. enterocolitica* strain 0:9 obtained from Institute für Milchhygiene und Milchtechnologie, Vet. Med. Univ., Vienna, Austria. The cultures for experiment were prepared by growing in trypticase soy broth (Difco) at 22°C for 48 h before inoculating into minced meat. Pot. sorbate (0.1 and 0.2%) and *N. sativa* (1 and 3%) were prepared according to Tsay and Chou (1989) and Mahmoud (1993), respectively. Minced meat was prepared and inoculated by two strains as recommended by Hefnawy et al. (1993). Different dilutions of the homogenate were prepared by using 0.1% peptone water as diluent, then 0.1 ml portions of three selective dilutions were spread-plated on CIN agar and incubated at 22-32°C for 24-48 h. (Schiemann, 1979). Typical colonies of *Y. enterocolitica* (dark-red "bull's-eye" surrounded by a transparent border) were counted. Confirmatory tests were done according to Speck (1984). Both temperature and pH were adjusted during the experiment.

Results and discussion

The results outlined in Table 1 revealed that there was a substantial multiplication of *Y. enterocolitica* serotype 0:8 in Pot. Sorbate and *N. sativa* – free minced meat sample (control). The maximum population reached 59×10^5 cfu/g in the examined sample kept for 72 h. at 3°C and pH 6. While samples containing 0.1 and 0.2% Pot. sorbate and 1 and 3% *N. sativa* showed a marked decrease in numbers of the organism. In comparison, the addition of 0.2% Pot. sorbate and 3% *N. sativa* caused greater decrease in *Y. enterocolitica* 0:8 number reaching its minimum counts of 20×10^5 and 19×10^5 cfu/g with reduction rates of 61.5 and 63.5% after 72 h., respectively. On the other hand, data illustrated in Table 2 showed that *Y. enterocolitica* 0:9 grew rapidly in the control sample with maximum population of 35×10^5 cfu/g after 72 h at 3°C and pH 6. While the addition of two concentrations of both Pot. sorbate and *N. sativa* during minced meat storage induced inhibitory effect on the population of *Y. enterocolitica* 0:9. Moreover, in minced meat samples containing 0.2% Pot. sorbate and 3% *N. sativa*, the strain reached its minimum count of 9×10^5 and 7×10^5 cfu/g after 72 h. of cold storage, with reduction rates of 64 and 72%, respectively. Therefore, it was concluded that the addition of 0.1 and 0.2% Pot. sorbate as well as 1 and 3% *N. sativa* improved the keeping quality of minced meat as compared with control. However, 0.2% of Pot. sorbate and 3% of *N. sativa* caused a marked inhibition in both strains of *Y. enterocolitica* count in comparison to other two concentrations as recorded in Tables 1 and 2. The antibacterial action of sorbate against *Y. enterocolitica* was in accordance to the findings observed by Tsay and Chou (1989), Restaino et al. (1981) and the report of Myers et al. (1983) who indicated that sorbate was effective in preventing growth of *Yersinia* in pork roasts. The efficacy of Pot. sorbate against *Y. enterocolitica* was greatly affected by pH and temperature, where the maximum inhibition was observed at 3°C and pH 5.5 as recorded previously by Tsay and Chou (1989). On the other hand, the extract of *N. sativa* seeds produced inhibition of Gram-positive bacteria represented by *Staph. aureus* and Gram negative bacteria represented by *Pseudomonas*, *Yersinia* and *E. coli* (Hanafy and Hatem, 1991).

Pertinent literature

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Table 1: Effect of Potassium sorbate and *Nigella sativa* on the growth of *Y. enterocolitica* 0:8 in minced meat kept at 3°C and pH 6.

Group	Zero time	24 h	Reduction Rate %	48 h	Reduction Rate %	72 h.	Reduction Rate %
Control	52x10 ⁵	53x10 ⁵	-	56x10 ⁵	-	59x10 ⁵	-
Pot. sorbate 0.1%	52x10 ⁵	50x10 ⁵	3.8	30x10 ⁵	42.3	21x10 ⁵	59.6
Pot. sorbate 0.2%	52x10 ⁵	51x10 ⁵	1.9	23x10 ⁵	55.8	20x10 ⁵	61.5
<i>N. sativa</i> 1%	52x10 ⁵	50x10 ⁵	3.8	28x10 ⁵	46.1	22x10 ⁵	57.7
<i>N. sativa</i> 3%	52x10 ⁵	48x10 ⁵	7.6	24x10 ⁵	53.8	19x10 ⁵	63.5

Table 2: Effect of Potassium sorbate and *Nigella sativa* on the growth of *Y. enterocolitica* 0:9 in minced meat kept at 3°C and pH 6.

Group	Zero time	24 h	Reduction Rate %	48 h	Reduction Rate %	72 h.	Reduction Rate %
Control	25x10 ⁵	27x10 ⁵	-	30x10 ⁵	-	35x10 ⁵	-
Pot. sorbate 0.1%	25x10 ⁵	20x10 ⁵	20	18x10 ⁵	28	16x10 ⁵	36
Pot. sorbate 0.2%	25x10 ⁵	17x10 ⁵	32	11x10 ⁵	56	9x10 ⁵	64
<i>N. sativa</i> 1%	25x10 ⁵	24x10 ⁵	4	14x10 ⁵	44	11x10 ⁵	56
<i>N. sativa</i> 3%	25x10 ⁵	17x10 ⁵	32	9x10 ⁵	64	7x10 ⁵	72