

## ***In vitro* antibacterial availability of bioconverted $\gamma$ -linolenic acid**

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### **Abstract**

Bioconverted hydroxy fatty acid from  $\gamma$ -linolenic acid showed antibacterial activity against Gram-positive bacteria such as *Bacillus subtilis* (ATCC 6633), *Listeria monocytogenes* (ATCC 19166), *Staphylococcus aureus* (ATCC 6538) and *S. aureus* (KCTC 1916) and one Gram-negative bacteria, *Pseudomonas aeruginosa* (KCTC 2004) with MIC ranging from 250 to 750  $\mu\text{g/ml}$  against five of eleven bacteria tested.

### **Introduction**

The hydroxyl group on fatty acid is well known to give fatty acid special properties, such as higher viscosity and reactivity compared with other normal fatty acids so that the hydroxy fatty acids are used in a wide range of industrial products.<sup>1)</sup>  $\gamma$ -Linolenic acid (GLA) is an important conditionally essential fatty acid (EFA). GLA is found naturally in the fatty acid fractions of some plant seed oils. In this paper we report the antibacterial availability of bioconverted GLA as determining the inhibition zone and MIC values against a range of food-borne pathogenic bacteria.

### **Materials & methods**

**Chemical** : GLA was purchased from Nu-Chek-Prep Inc. (Elysian, MN). The purity of fatty acid was over 95%.

**Microorganisms** : *Pseudomonas aeruginosa* PR3, kindly provided by Dr. Hou in USDA, was grown at 28°C aerobically at 200 rpm on standard medium containing per liter 4 g dextrose, 2 g  $\text{K}_2\text{HPO}_4$ , 2 g  $(\text{NH}_4)_2\text{HPO}_4$ , 1 g  $\text{NH}_4\text{NO}_3$ , 0.5 g yeast extract, 0.014 g  $\text{ZnSO}_4$ , 0.01 g  $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$  and 0.01 g  $\text{MnSO}_4 \cdot 7\text{H}_2\text{O}$ . Eleven strains of food-spoiling bacteria

were obtained from the Korea Food & Drug Administration, Daegu, Korea.

**Bioconversion of  $\gamma$ -linolenic acid :** Bioconversion was carried out in standard medium as mentioned above. Gamma-linolenic acid as substrate was added to a 24 h old culture followed by continued incubation for an additional 72 h. The culture broth was acidified to pH 2 with 6N HCl followed by immediate extraction twice with an equal volume of ethyl acetate and diethyl ether. The solvent was evaporated from the combined extract with a rotary evaporator and bioconverted oil extracts of gamma-linolenic acid were obtained.

### Results & discussion

The inhibition zones and MIC values for bacterial strains were in the range of 7 - 10 mm and 250 - 750  $\mu\text{g/ml}$  for the bioconverted GLA. In the present study, Gram-positive bacteria were more susceptible than Gram-negative bacteria to the bioconverted GLA (Table 1).

Table 1. Antibacterial activity of bioconverted gamma-linolenic acid

Bacteria tested	Inhibition zone (mm)	MIC ( $\mu\text{g/ml}$ )
<i>Bacillus subtilis</i> ATCC 6633	8	250
<i>Listeria monocytogenes</i> ATCC 19166	10	250
<i>Staphylococcus aureus</i> ATCC 6538	9	750
<i>Staphylococcus aureus</i> KCTC 1916	7	750
<i>Pseudomonas aeruginosa</i> KCTC 2004	9	500
<i>Escherichia coli</i> ATCC 8739	ND <sup>a</sup>	ND <sup>b</sup>
<i>Escherichia coli</i> O157:H7 ATCC 43888	ND <sup>a</sup>	ND <sup>b</sup>
<i>Escherichia coli</i> O157:H7 (hamburger)	ND <sup>a</sup>	ND <sup>b</sup>
<i>Enterobacter aerogenes</i> KCTC 2190	ND <sup>a</sup>	ND <sup>b</sup>
<i>Salmonella enteritidis</i> KCCM 12021	ND <sup>a</sup>	ND <sup>b</sup>
<i>Salmonella typhimurium</i> KCTC 2515	ND <sup>a</sup>	ND <sup>b</sup>

<sup>a</sup>ND = not detected antibacterial activity at the concentration of 2,000  $\mu\text{g/ml}$ .

<sup>b</sup>ND = not detected antibacterial activity at the concentration of 4,000  $\mu\text{g/ml}$ .

### Conclusions

Our results suggested that the use of bioconverted GLA is considered as antibacterial availability for the control of a number of pathogens and spoilage bacteria of traditional concern in food.

### Reference

1. Bagby, M. O., Calson, K. D. (1989) In: *Fats for the future*, Chichester, Ellis Horwood Limited Press, pp. 301-307.