

The Mutagenic and Antimutagenic Activity of *Lavandula angustifolia* and *Elettaria cardamomum* Essential Oils in the Bacterial Reverse Mutation Assay

Rahimifard N (Ph.D.)^{1,2,3*}, Hajimehdipoor H (Ph.D.)^{1,2,4}, Pirouz B (M.Sc.)^{1,2}, Bagheri F (M.Sc.)³, Bagheri O (M.Sc.)⁵, Mirdamadi KS (Pharm.D.)³

1- Department of Microbiology, Food and Drug Laboratory Research Center (FDLRC), Tehran, Iran

2- Department of Microbiology, Food and Drug Control Laboratories (FDCLs), Ministry of Health (MOH), Tehran, Iran

3- Department of Microbiology, Pharmaceutical Sciences Branches, Islamic Azad University, Tehran, Iran

4- Pharmaceutical Faculty, Shahid Beheshti University, Tehran, Iran

5- Molecular Biotechnology Research Center, Baqiatallah University of Medical Sciences, Tehran, Iran

*Corresponding author: Department of Microbiology, Food and Drug Laboratory Research Center (FDLRC), Tehran, Iran

Tel: +98 – 912 - 1032806, Fax: +98- 21- 66417252

Email: rahimif@fdo.ir, rahimif@sina.tums.ac.ir

Receive: 2 Jul. 2010

Acceptance: 31 Aug. 2010

Abstract

Background: Essential oils from *Elettaria cardamomum* (cardamom oil) and *Lavandula angustifolia* (Lavender oil) are used a lot in food and Drug Industry. Cardamom oil traditionally used as spice in food now is increasingly used as diuretic, sedative and for gastrointestinal disease. Lavender oil, traditionally used as an antiseptic agent, is now widely used as a relaxant, carminative, and sedative in aromatherapy.

Objective: They both are used as flavouring additives in food and medical industry. It's very important to know their mutagenic potential. Meanwhile, the growth of cancer disease and insufficient chemical treatments are among main reasons for the antimutagenic effect of essential oils to be assessed.

Methods: In this study we investigated the mutagenic and antimutagenic activities of cardamom oil and lavender oil by the bacterial reverse mutation assay in *salmonella typhimurium* TA98 and TA100 strains with and without S9 (microsomal mutagenesis assay) for 7 dilutions of each essential oils.

Results: The mutagenicity effects were not seen in all dilutions of each essential oils, and antimutagenicity effect was seen in 0.40 and more concentration (mg/plate) of *Elettaria cardamomum* by the bacterial reverse mutation assay in *salmonella typhimurium* TA98 strains without S9.

Conclusion: Assessment of genotoxic potential and identification of mutagenic components of essential oils has been considered widely after their increasing consumption rate, in order to investigate possible new activities of herbal essential oils like antimutagenic effect possibly leading to new and safer products.

Although the antimutagenic activity of lavender oil is an interesting finding, further studies are required to identify the components responsible for its antimutagenic action.

Keywords: Bacterial reverse mutation assay, Antimutagenicity, Essential oils, *Elettaria cardamomum*, *Lavandula angustifolia*

Introduction

The large-scale use of essential oils requires accumulation of toxicological data on these substances. Essential oils contain a complex mixture of odorous and volatile compounds from secondary plant metabolism, and are widely used in cosmetics as fragrance components and in the food industry as flavouring additives [7]. Increasing human exposure to these compounds makes mutagenicity effect of these compounds very important to study in order to protect human population from their toxic and adverse effects [2].

In this study we first assessed the mutagenic potential of cardamom oil and lavender oil, if they proved negative, we investigated their antimutagenic activity [1, 4, 5].

Materials and Methods

Dose –dependent inhibitory effect (MIC) of 2 essential oils including, cardamom oil and

Lavender oil, their mutagenicity in the Ames salmonella reversion assay were studied in microbial Test system with and without S9 (microsomal mutagenesis assay) for 7 dilution of each essential oils, from 1.0 to 1000 ppm. Antimutagenicity was assayed as previously described by Ames [1].

Results

Under our experiments, in mutagenicity test, it was not any mutagenic effect with or without S9 for Lavender oil and cardamom oil. Lavender oil had significant antimutagenic activity against 2-nitrofluorene in the TA98 strain, Lavender exerts its antimutagenic effect in 0.25 mg/plate with moderate antimutagenic activity and in concentrations higher than 0.40 had severe antimutagenic activity. (Table 1 & 2).

Table 1- Antimutagenicity and Mutagenicity of the essential oils of *Elettaria cardamomum* (cardamom oil) and *Lavandula angustifolia* (Lavender oil) to *Salmonella typhimurium* (TA98, TA100) with and without S9

| Test Item | Concentration (mg/plate) | Number of Counted Colonies | | | | | | | |
|----------------|--------------------------|----------------------------|-----|-------|------|--------------------|-----|-------|-----|
| | | Antimutagenicity | | | | Mutagenicity(Ames) | | | |
| | | TA98 | | TA100 | | TA98 | | TA100 | |
| | | -S9 | +S9 | -S9 | +S9 | -S9 | +S9 | -S9 | +S9 |
| Lavender Oil | 0.80 | 185 | 560 | 630 | 1602 | 45 | 43 | 80 | 77 |
| | 0.66 | 210 | 550 | 650 | 1630 | 48 | 46 | 79 | 78 |
| | 0.50 | 230 | 530 | 650 | 1605 | 46 | 45 | 81 | 83 |
| | 0.40 | 268 | 520 | 660 | 1725 | 49 | 47 | 78 | 77 |
| | 0.25 | 352 | 520 | 680 | 1700 | 45 | 56 | 79 | 78 |
| | 0.13 | 410 | 510 | 690 | 1610 | 46 | 44 | 79 | 77 |
| Cardamom Oil | 0.80 | 510 | 485 | 630 | 1500 | 50 | 48 | 83 | 81 |
| | 0.66 | 450 | 435 | 625 | 1550 | 49 | 50 | 80 | 79 |
| | 0.50 | 340 | 430 | 635 | 1600 | 51 | 49 | 81 | 80 |
| | 0.40 | 430 | 510 | 610 | 1350 | 51 | 50 | 80 | 79 |
| | 0.25 | 430 | 510 | 640 | 1300 | 52 | 51 | 79 | 77 |
| | 0.13 | 400 | 515 | 640 | 1300 | 50 | 49 | 80 | 78 |
| DMSO (Vehicle) | 100 µl | 31 | 33 | 88 | 85 | 42 | 41 | 68 | 66 |

Table 2- Refrence positive Controls

| Refrence Positive Controls | Concentration (µg/plate) | Number of Counted Colonies | | | | | | | |
|----------------------------|--------------------------|----------------------------|-----|-------|------|---------------------|-----|-------|-----|
| | | Antimutagenicity | | | | Mutagenicity (Ames) | | | |
| | | TA98 | | TA100 | | TA98 | | TA100 | |
| | | -S9 | +S9 | -S9 | +S9 | -S9 | +S9 | -S9 | +S9 |
| 2-nitrofluorene | 6 | 525 | - | - | - | - | - | - | - |
| 2-aminoanthracene | 5 | - | - | - | 1100 | - | - | - | - |
| sodium azide | 5 | - | - | 610 | - | - | - | - | - |
| 2-aminoanthracene | 25 | - | 620 | - | - | - | - | - | - |

Discussion

This study by the bacterial reverse mutation assay showed that *Lavandula angustifolia* and *Elettaria cardamomum* essential oils have no mutagenic activity with or without S9 either in the TA98 and TA100 *Salmonella typhimurium* strains, Like Cavanagh, H.M et al reports [3] and Jamal A et al reports [6].

Our experiments results show that lavender oil protects against the mutagenicity induced by 2-nitrofluorene in the TA98 strain. Lavender oil exerts its antimutagenic effect without S9,

that confirm M.G. Evandri et al results [8]. Assesment of genotoxic potential and identification of mutagenic components of essential oils has been considered widely after their increasing consumption rate, in order to investigate possible new activities of herbal essential oils like antimutagnic effect possibly leading to new and safer products.

Although the antimutagenic activity of lavender oil is an interesting finding, Furthur studies are required to identify the components responsible for its antimutagenic action.

References

1. Ames BN, Mc Cann J, Yamasaki E, Methods for detecting carcinogens and mutagens with the Salmonella/mammalian-microsome mutagenicity test. *Mutat. Res.* 1975; 31: 347 – 64.
2. Barnes J. Pharmacovigilance of herbal medicines. A UK perspective. *Drug Safe.* 2003; 26 (12): 829 – 51.
3. Cavanagh HM, Wilkinson JM, Biological activities of lavender essential oil. *Phytother. Res.* 2002; 16: 301 – 8.
4. Maron DM, Ames BN, Revised methods for the Salmonella Mutagenicity test. *Mutant. Res.* 1983; 113: 173 – 215.
5. Organisation for Economic Cooperation and Development (OECD) Guideline for the testing of chemicals: bacteria reverse mutation test, Guideline 1997, p: 471.
6. Jamal A, Javed K, Aslam M, Jafri MA. Gastroprotective effect of cardamom, *Elettaria cardamomum* Maton. fruits in rats. *J. Ethnopharmacol.* 2006; 103: 149 – 53.
7. Gilani AH, Jabeen Q, Khan AU, Shah AJ Gut modulatory, blood pressure lowering, diuretic and sedative activities of cardamom. *J. Ethnopharmacol.* 2008; 115: 463 – 72.
8. Evandri MG, Battinelli L, Daniele C, Mastrangelo S, Bolle P, Mazzanti G, The

antimutagenic activity of *Lavandula angustifolia* (lavender) essential oil in the

bacterial reverse mutation assay. *Food and Chemical Toxicology* 2005; 43: 1381 – 9.

Archive of SID