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

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Abstract

Background: Essential oils from *Elettaria cordamomum* (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 cordamomum* 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 antimutagnic 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 angustfolia*

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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 secondry 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 investingated 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 sever 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

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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.

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