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THE ANTIMICROBIAL ACTIVITY OF SOME EXTRACTS OF BASIL AND GINGER

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Abstract
Plants are more and more used in prophylaxis and therapeutics of many diseases, because they are reasonable alternative to synthetic drugs. The low cost of herbal medicine and the less number of side effects than synthetic drugs are the most important advantages for treatments in some common and primary symptoms of multiple diseases. Despite the conventional drugs rapid effects in acute diseases, the exploration of plants antimicrobial potential is a better choice in medicine.
In this study the antimicrobial effects of essential oils, ethanolic, methanolic and aqueous extracts against three bacterial strains were tested. The essential oils and the extracts were gained from two plants often used in cookery, basil and ginger. The extracts were obtained in certain condition and variants. The most obvious effect was observed for essential oils because of their concentration. The antimicrobial effect of alcoholic extracts was more obvious after concentration by evaporation and the aqueous extracts had quite low antimicrobial effect.

Keywords: Antibacterial effect, basil, ginger, essential oils, plant extracts

1. INTRODUCTION

Plants have been used in traditional medicine since ancient times to cure many diseases. The benefits of medicinal herbs determine of late years an increasing interest for using plants for medical purposes. It is already known that *Plantae* Kingdom is a great source of pharmaceutical, aromatic and industrial compounds. Thanks to the contents of many organic compounds, plants can be used as raw material in scientific, technological and commercial uses (Niculae et al., 2008).
Organically grown plants and plants from wild flora are useful sources to cure many infectious diseases. For instance, one of the antimicrobial effects of plants consist of inhibition of bacterial virulence factors such as proteases.
Plants contain compounds known as ”secondary metabolites” such as isoflavones, anthocyanins and flavonoids (Akintobi et al., 2013). On the one hand, these compounds give the unique taste and smell and, on the other hand, the antimicrobial effect of plants used in cookery. Also, many research demonstrated the effect of phenols against bacteria and insects in medicinal plants essentials oils (Zaki et al., 2015).
The aim of this study was testing the antimicrobial potential of two plants often used in cookery, basil and ginger. The effect against bacteria of essential oil, alcoholic and aqueous extracts were established.

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2. MATERIAL AND METHOD

In this study the essential oils and the extracts obtained from species *Ocimum basilicum* L. (basil) and *Zingber officinale* Roscoe (ginger) were used.

A. Plant material

The 100% pure essential oils of basil (”Adams”) and ginger (www.naturela.ro) obtained by water vapour distillation were bought.

The alcoholic and the aqueous extracts were obtained in laboratory. The dry basil (”Mr. Spice”, Egypt), the fresh ginger rhizome from China and the powder of ginger rhizome (”Kotanyi”, Austria) were used.

- ✓ ***Extracts preparation***

The fresh ginger rhizome was cleaned with sterile distilled water, peeled and minced using sterile knife.

The fresh ginger rhizome, the powder of ginger rhizome and the dry basil were weighed using an analytical balance and were immersed in solvents. The extracts were prepared at room temperature in 72 hours and then, these were filtered using Double Rings 12,5 cm filter paper.

The basil alcoholic extracts were prepared by adding 100 ml ethanol 96° (for ethanolic extract), respectively methanol 100% (for methanolic extract) over 20 gr. chopped dry aerial parts of plant.

The basil aqueous extracts were prepared by adding 200 ml distilled water at 60°C and 80°C over 20 gr. chopped dry aerial parts of plant.

The fresh ginger rhizome and the powder ginger rhizome extracts were prepared in two concentrations. The extracts were obtained by adding 100 ml (for 1:5 concentration) and 80 ml (for 1:4 concentration) ethanol 96°/methanol 100%/distilled water at 80°C over 20 gr. powder of ginger rhizome/chopped ginger rhizome. All experimental variants are presented in Table 1.

- ✓ ***Extracts preservation***

The extracts obtained were introduced in shut close recipients and preserved at 4°C in a refrigerator. Alcoholic extracts were concentrated by evaporation at room temperature near two fold.

B. Bacterial strains

Three bacterial strains were used in experiments. One of them was a reference bacterial strain of *Staphylococcus aureus ATCC* 25923 (S.a.). The second bacterial strain was isolated from human urinary tract infection, identified in 2013 by API 20E test kit (Biomerieux) as *Citrobacter freundii* (C.f.). The third bacterial strain was a lactic acid bacteria isolated from ”Napolact” yogurt sample marked as BL 68.

C. Antimicrobial effect

The antimicrobial activity of essential oils and extracts was tested by disc diffusion method against three bacterial strains.

According to diffusion method, the tested extract diffuses radial on the surface of agar and it creates a concentration gradient inversely proportional with the distance to disc (Sebiomo et al., 2011; Ahmad-Ch et al., 2015).

Standard antibiotic discs (Tetracycline 30µg Bioanalyse - TE) were used as a positive control. The negative control was the solvent, ethanol 96° (E), methanol 100% (M), distilled water at 60°C (A60), respectively distilled water at 80° (A80); 6 mm Ø filter paper discs, sterilized by heating in oven and impregnated with solvents, essentials oils and extracts were used.

An overnight (16 to 24 h) culture of each bacterial strain was obtained at 37°C by inoculating the microorganisms into 3 ml nutrient broth; after incubation, the concentration was close to 0,5 McFarland turbidity standard.

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The bacterial cell suspensions were uniform inoculated on the surface of nutrient agar in plates (4 mm level depth) using single use nasopharyngeal swabs. After inoculation, the controls and the discs impregnated in essential oils and in extracts were put on the surface using an iris forceps and the plates were incubated inverted at 37°C for 24 hours.
The antimicrobial effects of essential oils and extracts were estimated by measuring the diameter of inhibition growth zone (in millimetres), as a clear, distinct zones of inhibition around discs, compared to positive and negative controls. The diameter of inhibition growth zone is directly proportional with microorganism susceptibility at tested extract.

Table 1. Experimental variants

Plant material	Solvent	Symbol
Basil - dry aerial parts	Ethanol (1:5)	EEB
Basil - dry aerial parts	Methanol (1:5)	EMB
Basil - dry aerial parts	Distilled water 60°C (1:10)	EAB1
Basil - dry aerial parts	Distilled water 80°C (1:10)	EAB2
Basil pure essential oil		UB
Fresh ginger rhizome	Ethanol (1:5)	1GRE
Fresh ginger rhizome	Ethanol (1:4)	2GRE
Powder ginger rhizome	Ethanol (1:5)	1GPE
Powder ginger rhizome	Ethanol (1:4)	2GPE
Fresh ginger rhizome	Methanol (1:5)	1GRM
Fresh ginger rhizome	Methanol (1:4)	2GRM
Powder ginger rhizome	Methanol (1:5)	1GPM
Powder ginger rhizome	Methanol (1:4)	2GPM
Fresh ginger rhizome	Distilled water 80°C (1:5)	1GRA
Fresh ginger rhizome	Distilled water 80°C (1:4)	2GRA
Powder ginger rhizome	Distilled water 80°C (1:5)	1GPA
Powder ginger rhizome	Distilled water 80°C (1:4)	2GPA
Ginger pure essential oil		UG

3. RESULTS AND DISCUSSIONS

In terms of antimicrobial effect, this study revealed differences between essential oils, alcoholic and aqueous extracts of ginger and basil.
The essential oils were the most efficient products against all three bacterial strains, especially basil essential oil. The most obvious antimicrobial effect of basil essential oil was similar to effect of positive control (TE) against BL 68 and *Citrobacter freundii*, the inhibition growth zones were 20 mm for both tested strains (Table 2). The most resistant bacterial strain to ginger and basil essential oils was *Staphylococcus aureus*, the inhibition growth zones were much smaller than positive control.
Concerning the alcoholic extracts, the antimicrobial effect was low before concentration, but it slightly increased after concentration by evaporation (from maximum 9-10 mm to maximum 10-12 mm). The most susceptible strains to basil extracts were BL 68 and *Citrobacter freundii*.
Alcoholic extracts of ginger powder were mostly more efficient than alcoholic extracts of ginger rhizome. The most obvious antibacterial effect of ginger powder methanolic extracts was against BL 68 and the inhibition zone growth was 12 mm (Table 3). This antibacterial effect of ginger suggests that it can be used into medications for some antibacterial treatment (Hasan et al., 2012).
Aqueous extracts had low antimicrobial effect. The maximum of inhibition growth zone were 7 mm. The most susceptible strain was *Staphylococcus aureus*, but the same results were noticed the some negative controls (Table 4).

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Table 2. Antimicrobial effect of essential oils

Sample	Microorganism/Inhibition zone (mm)		
	S.a	C.f.	BL 68
UB	10	20	20
UG	9	10	12
TE	20	15	25

Table 3. Antimicrobial effect of alcoholic extracts

Sample	Microorganism Inhibition zone (mm) after concentration			Sample	Microorganism Inhibition zone (mm) after concentration		
	S.a.	C.f.	BL 68		S.a.	C.f.	BL 68
EEB	7	0	9	1GRM	7	0	6.5
1GRE	6.5	9	0	2GRM	7	0	6.5
2GRE	6.5	6.5	0	1GPM	6.5	8	9
1GPE	7	10	8	2GPM	7	8.5	12
2GPE	8	7	9	E	7	6.5	7
EMB	8	10	9	M	0	6.5	7
				TE	20	15	25

Table 4. Antimicrobial effect of aqueous extracts

Sample	Microorganism/Inhibition zone (mm)			Sample	Microorganism/Inhibition zone (mm)		
	S.a.	C.f.	BL 68		S.a.	C.f.	BL 68
EAB1	0	7	0	1GPA	7	0	0
EAB2	7	0	0	2GPA	7	0	7
1GRA	7	0	0	A60	0	0	0
2GRA	7	0	7	A80	7	0	7
				TE	20	15	25

4. CONCLUSIONS

This study denoted the antimicrobial activity of basil and ginger essential oils was the highest against all tested strains and the most susceptible strain was BL 68.

Alcoholic extracts presented a low antimicrobial effect before concentration, but it could slightly increase after concentration by evaporation. Some further studies with more concentrated extracts can define better effects. The highest effect of alcoholic basil extracts was against *Citrobacter freundii* and the highest effect of alcoholic ginger extracts was against lactic acid bacteria strain BL 68. The ginger powder seems to be more efficient than ginger rhizome in order to obtain antibacterial product.

The aqueous extracts presented quite low effects against the tested bacterial strains.

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