Essential oils: possible resources for the treatment of anaerobic bacterial infections

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INTRODUCTION

Anaerobic bacteria are important constituents of the human microbiota found in numerous districts that, under specific conditions, may be responsible for clinically relevant infections [1]. Despite their increased incidence and significant role in human health, treatment is often based on empirical therapies and Antibiotic Susceptibility Testing (AST) is not always routinely performed. Given the unpredictable nature of antibiotic resistance patterns and the emergence of new resistance factors, AST is now more crucial than ever as well as the development of alternatives to the most commonly used drugs. In this scenario essential oils (EOs), natural terpene phytocomplexes known for their antimicrobial activity [3, 4], despite being widely studied as natural antibiotic alternatives, lack in solid scientific evidences about their action on anaerobic bacteria. The aim of the study was to evaluate the antimicrobial efficacy of 4 EOs against anaerobic bacteria, isolated from purulent materials, in order to identify the most effective ones to use in the treatment of anaerobic bacterial infections.

METHODS

4 anaerobic bacteria (*Bacteroides fragilis*, *Prevotella bivia*, *Clostridium perfringens*, *Cutibacterium acnes*) have been isolated from patients' purulent biological materials. The antibiotic sensitivity profile was evaluated through the disc diffusion assay (Fig. 1), performed according to the European Committee on Antimicrobial Susceptibility Testing (EUCAST) international guidelines. Broth microdilution (BMD) susceptibility tests were performed to assess the antimicrobial efficacy of 4 EOs: *Cinnamomum zeylanicum* from bark, *Cymbopogon martinii* (CT geraniol), *Cymbopogon citratus* (CT neral), *Illicium verum* (CT trans-anethole).

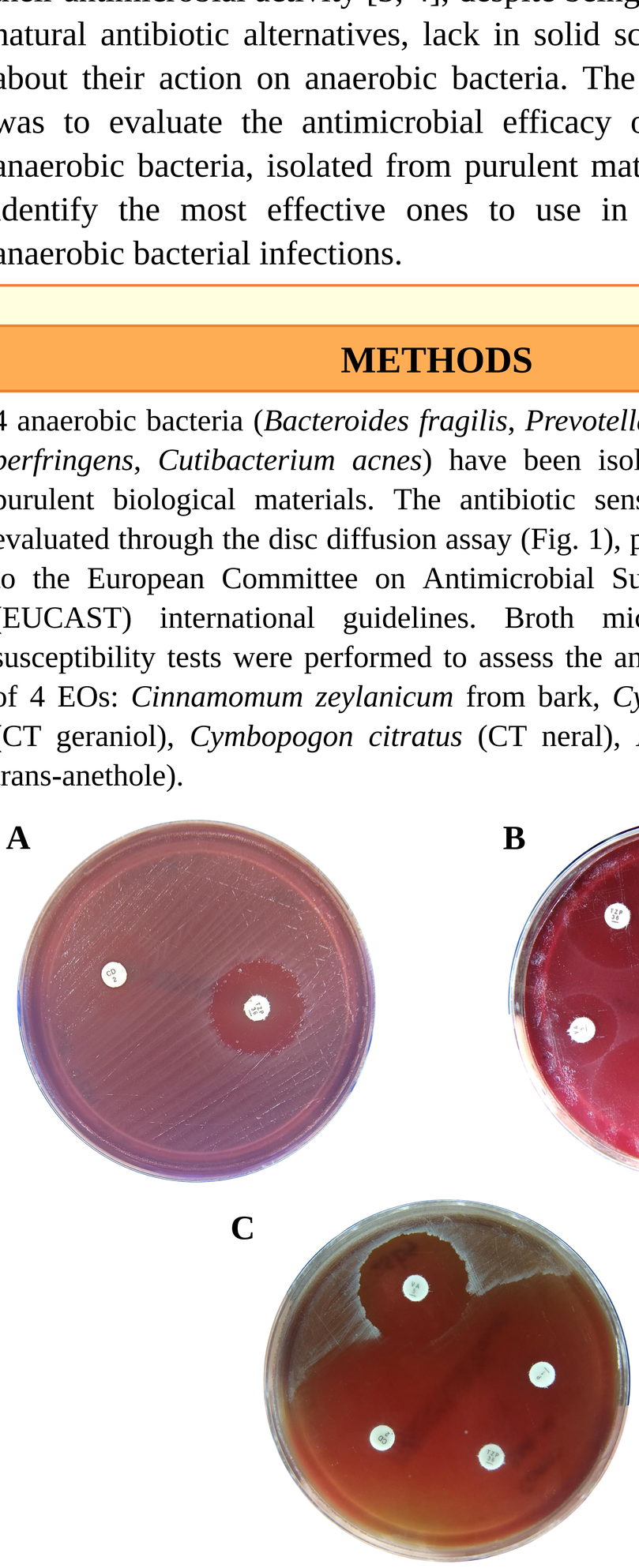

Figure 1. Disk diffusion assay: A) *B. fragilis*; B) *C. perfringens*; C) *C. acnes*.

RESULTS

The disc diffusion assay showed that only *C. acnes* was sensitive to all the tested antibiotics. *B. fragilis* was resistant to Meropenem and Clindamycin, *P. bivia* to benzylpenicillin and *C. perfringens* to Clindamycin (Table 1). The *in vitro* sensitivity of the bacterial strains against the EOs was investigated through the BMD test. As shown in Table 2, 3 EOs showed a strong antimicrobial activity for all strains, with minimal inhibitory concentration (MIC) values <0.06% *v/v* for *C. zeylanicum* and *C. citratus*, and ≤0.12% *v/v* for *C. martinii*; l'*I. verum* had the weakest antimicrobial activity (MIC ≥2% *v/v*).

Microorganism	TZP	MEM	CD	MTZ	P	VA
B. fragilis	S	R	R	S	-	-
P. bivia	S	S	S	S	R	-
C. perfringens	S	S	R	S	S	S
C. acnes	S	S	S	-	S	S

Table 1. Sensitivity of bacteria to antibiotics. TZP: Piperacillin/Tazobactam; MEM: Meropenem; CD: Clindamycin; MTZ: Metronidazole; P: benzylpenicillin; VA: Vancomycin.

Microorganism	*C. zeylanicum*	*C. martinii*	*C. citratus*	*I. verum*
B. fragilis	<0.06	<0.06	<0.06	2
P. bivia	<0.06	<0.06	<0.06	>2
C. perfringens	<0.06	<0.06	<0.06	>2
C. acnes	<0.06	0.12	<0.06	>2

Table 2. Susceptibility testing against natural products: MIC (%*v/v*).

CONCLUSION

Although further investigations are required, these preliminary data are promising. EOs can be considered natural antimicrobial substances for the development of new therapeutic approaches for the treatment of anaerobic bacterial infections.

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