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Several Combinations Containing Plant Extracts for Human Health

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Abstract

With the significant increase in the diffusion of diseases and the development of drug resistance by human pathogenic bacteria, there is a permanent need to discover new antimicrobial compounds from plants. Plant extracts containing various effective chemicals such as polyphenols, thymol, carvacrol, cinnamic acid and eugenol, give wide-range of medical options for treatment chronic and contagious diseases with higher safety profile and less side effects. So, The objective of the present work was to revision the confirmations about various plant extracts activity as a source of an effective antibacterial compounds, within in-vitro antibacterial tests on different bacterial strains. Overall, the studies explore a well-educated methodology for evaluating the activity of various combinations containing plant extracts as stable antibacterial agents, further human-health researchers are still needed to reassure a clear cause-impact.

Keywords: Polyphenols; Thymol; Carvacrol; Chewable Lozenges; Antibacterial Activities

Introduction

One of the common problems in treatment is the emergence of drug resistance such as the multidrug-resistant microorganisms (*Acinetobacter baumannii*, *Escherichia coli*, *pseudomonas aeruginosa* and *staphylococcus aurous*) which has become a major global problem in hospital environments and is considered to be one of the main causes of health care infections and has caused increased morbidity and mortality rates [1,2]. Therefore, the time of relying on synthetics drugs is over, and people turned to natural alternatives in the hope of gaining safety and security. Herbal medicine called phytochemistry, has been used for the treatment of several diseases considered to be safe, effective, more acceptable and compatible with the human body [3,4].

Aromatic herbs were used to give foods flavor and taste; at the same time, it has antibacterial properties [5]. Phenolic compounds are found mainly in the plant kingdom [6]. Figure 1 shows the chemical structures of some effective compounds obtained from plants.

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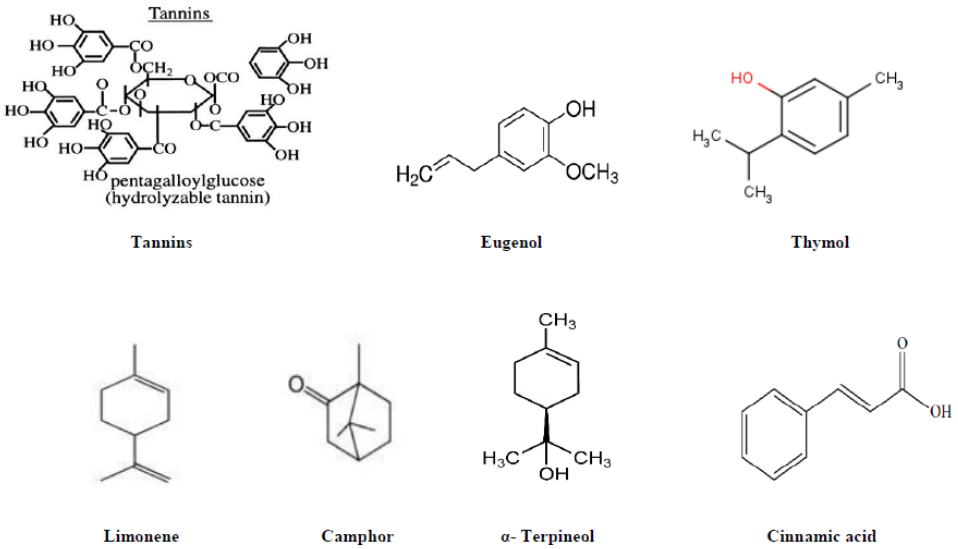

Figure 1: The Chemical Structures of Some Effective Compounds Obtained from Plants.

Berries, Cinnamon, and Cloves [9-11].

Many studies have investigated the antimicrobial activity of some polymers fortified with some plant extracts, one of these studies focused on chewable lozenges which contain a combination of myrtle berries, cinnamon, and cloves as an effective mouthwash. The oral cavity is the main entrance to both the digestive and respiratory systems. Poor oral health can therefore significantly impact many chronic conditions and systemic diseases [12]. This study tests their antibacterial effect against two specific strains of *Streptococcus sp*. *Streptococcus sp*. That is the most common oral microflora that play an important role in the human microbial community [13]. The article provides a detailed description of the preparation of the extract and the various gelling agents used in preparing the lozenges, and evaluating their effectiveness through in-vitro dissolution testing using USP dissolution apparatus with a detailed description of the in-vitro dissolution test parameters, including the dissolution medium, rotational speed, sampling time, and temperature, as well as, the quantity of total polyphenols in prepared lozenges [14,15]. Then, the optimal formulas of chewable lozenges were studied based on their stability at temperature (4°C) for three months [4,16] then the antibacterial activity on *Streptococcus pyogenes* and *Streptococcus pneumonia* using the agar-well diffusion method [17].

In another study, a mixture based on salep enhancing with pistacia leaves extract, various parameters were studied to characterize the resulting mixture, such as pH measurement, moisture content [18], the general bacterial count test was also performed, including the preparation of nutritious medium, initial suspension and appropriate decimal extensions, digested time, bacterial culture and incubation temperature. The enumeration of bacterial colonies was studied on different four newly prepared mixtures and after 30 and 60 days of storage.

In another study the antimicrobial activity of a mixture of salep and starch enhanced with extracts of Thyme and Oregano against different types of bacteria such as *Pseudomonas aeruginosa*, *Klebsiella pneumoniae*, *Enterobacter cloacae*, *Acinetobacter boumannii*, *Staphylococcus aureus*, *Streptococcus pyogenes*, *Proteus mirabilis* and *Escherichia coli* was evaluated.

Results showed that chewable lozenges containing gelatin and salep either with or without sugar have the best physicochemical properties, highest polyphenols release rate at both saliva and gastric simulated media [19,20], the results also showed that the release rate of polyphenol in both mediums did not vary significantly, which was attributed to the synergistic effects of the biopolymers (gelatin and salep) [21], and to cross-linking reactions between the molecular chains of proteins and polysaccharides [22]. The results showed that the low storage temperature was an additional factor in maintaining the stability of polyphenols during the three-month storage period [23], as shown in Table 1.

Parameters	Lozenge Sample	
	First Month	Third Month
pH	6.13±0.28	6.12±0.29
Thickness (mm)	5.1±0.95	4.3±0.38
Dissolution % (pH 6.8, 30 min)	84.14±2.26	82.88±2.19
Dissolution % (pH 1.2, 1 h)	96.31±3.09	94.48±1.94
Appearance Stickiness and grittiness	No change	No change

Table 1: Results of the Stability Study.

The chewable lozenges showed a good effect against both types of bacteria, with a diameter zone of inhibition of 14 mm against *S. pyogenes* and 17 mm against *S. pneumonia*. In which, the antimicrobial activity of myrtle berries, cinnamon, and cloves extract is attributed to their high content of phenolic components with 7.82 g/100 g, as previously demonstrated in previous study [10,24,25].

The mixtures modified with thyme extract showed high activity against different types of bacteria such as *Enterobacter cloacae*, *Klebsiella pneumonia* and *Acinetobacter boumannii*, with a diameter of inhibition zone of (15,14,15mm) respectively. Whereas, the mixtures modified with Oregano showed high antibacterial activity against Streptococcus pyogenes only. The results had been shown in Table 2.

Microorganism	Diameter Zone of Inhibition (mm)	$LSD_{0.05}$
Enterobacter cloacae	15^{D}	0.594
Klebsiella pneumonia	14^{E}	
Acinetobacter boumannii	15^{D}	
Pseudomonas aeruginosa	17^{C}	
Staphylococcus aureus	18^{B}	
Streptococcus pyogenes	22^{A}	

Table 2: Effect of Mixtures Modified with Thyme Extract on Different Microorganism.

The antibacterial effectiveness is attributed to the essential oils such as Thymol, Carvacrol, Menthol and Anethole present in both thyme and oregano, which inhibit the growth of bacteria and yeasts [26-28].

Studies have also shown Pistacia leaves extract has a significant antibacterial activity, a decrease in total bacterial count as the concentration of extract increased from 0% to 5% (w/w). Moreover the total bacterial count was observed to growing significantly when the extraction concentration increased after 30 and 60 days of storage respectively, and results are reported in Table 3.

Storage Time	Mixtures		$LSD_{0.05}$
	Control (0%)	Mixture (5%)	
New	3500^{C-a}	100^{B-c}	430.18
After 30 days	400000^{B-a}	200^{AB-c}	2536.14
After 60 days	1000000^{A-a}	300^{A-c}	4718.13
$LSD_{0.05}$	4601.13	103.29	

Table 3: Effect of storage time and concentration of pistacia leaves extract on the bacterial load [CFU/ml] of the different salep mixtures.

This is due to the fact that it contains volatile aromatic compounds, the most important of which are phenolic acids and flavonoids [29,30], with 17.73 g/100g of total phenolic content [6]. It has been shown that adding glycerine improves the solubility and homogeneous dispersion of the extract within the mixture, which increases its antibacterial effectiveness [31].

Conclusion

The article focused on the formulation and evaluation the effectiveness of several mixtures based on various polymers supplemented with plant extracts against several types of bacterial strains. Thus, because of the antimicrobial effect of tested mixtures, they could be considered as antibacterial agents that could be potentially used in medical preparations industry.

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