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Original Article

Estimation and Investigation of Antimicrobial Activity of 5-methyl Acetyl Salicylic Acid against Two Pathogenic Fungi

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ABSTRACT

The current research was carried out to estimate and investigate the antimicrobial activity of phenolic compound represented by 5- methyl acetyl salicylic acid. Six concentrations of this acid were applied for measurement of antifungal activity are 25,50,75,100,150,and 170 mg/ml where they showed inhibition zone diameters equal to 19,21,28,29,35and 40mm against *Candida albicans* fungus and the same concentrations recorded inhibition zone diameters equal to 15,23,26,30,40,and 55 mm against *Aspergillus* sp. Fungus. So, this carboxylic acid is considered as an active chemical compound and it can be used as a synthetic drug to treat several various diseases caused by these pathogenic fungi but this work demands further clinical and pharmaceutical researches.

Keywords: Methyl acetyl salicylic acid, Phenolic group, Antifungal activity, Inhibition zone diameter, Pathogenic fungi.

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INTRODUCTION

Antimicrobial activity is one of the best procedures to estimate, investigate and evaluate the potential and biochemical ability of different active chemical compounds which are gotten from synthetic methods and also naturally isolated and identified from various medicinal plants. Several various researches have been ensured the role of antibacterial, antifungal, antiparastic and anticancer activities in inhibition or killing of pathogenic microorganisms which cause different infections in the human kind and animals leading to rising the various diseases then lately cause biochemical and physiological disorders in living organism (1,2).

Also the comparison of antimicrobial of any chemical compound with drugs used as therapies for different diseases , is excellent proceeding to know which of them the best in inhibition zone diameters value then evaluation of their biochemical potential as therapies to treat the intractable infectious human diseases including bacterial and fungal infections leading to isolate the active chemical compounds naturally and chemically from various medicinal plant or chemical synthesis of active drugs then both of therapies have medicinal properties and biochemical importance in the life (3,4).

The various literatures have been indicated that organic and aqueous chemical extracts of different and medicinal herbs and plants have ability and potent as good antimicrobial activity compared with various standard antibiotics such as penicillin, nystatin and ampicillin since natural active chemical compounds isolated from medicinal plants do not possess side effects. Also synthetic drugs which are manufactured have excellent physiological and clinical effects and they show very good medicinal results leading to treat different human diseases (5,6). Synthetic phenolic carboxylic acid such as 5- bromo acetyl salicylic acid and 5- nitro acetyl salicylic acid were carried out against growth of some pathogenic bacteria which were represented by *E. coli* and *Staphyllococcus eureus* and these acids showed and recorded excellent result concerning inhibition zone diameters then as a conclusion they have great antibacterial activity (7).

Phenolic compounds are considered as organic compounds having phenolic groups in their chemical structures and they are regarded as one such group that are synthesized by plants during the development and in response to conditions such as infections, wounding, ultraviolet radiation. Approximately 8000 naturally occurring chemical compounds belong to the category of phenolic and all of which share a common structural property, an aromating ring bearing at least one hydroxyl group, for example phenol compounds is aromatic one has one hydroxyl group as a substituent. The term phenolic acids generally designates phenols that possess one carboxyl group which is considered as the functional group. However, plant metabolite constituents belonging to phenols are metabolitic phenolic compounds. The naturally phenolic acids have two distinctive carbons in the framework of molecule. Although the basic skeleton remains the same, the numbers and positions of the hydroxyl groups on the aromatic ring make the difference and establish the variety (8,9).

The present study was designed to investigate and estimate the antimicrobial activity of 5- methyl acetyl salicylic acid against two pathogenic fungi which are represented by *Candida albicanis* and *Aspergillus* sp.

EXPERIMENTAL

Preparation of substituted phenolic carboxylic acid: the phenolic carboxylic acid represented by 5- methyl acetyl salicylic was previously prepared, purified, and spectrophotometrically identified (10).

Preparation of pathogenic fungal isolates: Two isolates pathogenic fungi are *Candida albicans*, *Aspergillus* sp. Were isolated and characterized by a special microbiologist at microbiology laboratory in bio development department in marine science center at university of basrah.

Investigation and estimation of antifungal activity: antifungal activity of 5- methyl acetyl acid was carried out and recorded by using two pathogenic fungi isolates which were represented by *Candida albicans*, *Aspergillus* sp. And these fungi were prepared and identified under suitable conditions. Different concentrations series were prepared from the phenolic acid (5-methyl acetyl salicylic acid) which were represented by 25, 50, 75,100,150 and 170mg/ml and their antifungal activity was investigated and estimated against growth of Candida *albicans*, *Aspergillus* sp. In the sake of calculation of inhibition zone diameters gotten by the effect of these concentrations. The estimation of antifungal activity was achieved by a sing diffusion method in petri dishes and the concentration of phenolic carboxylic acid were treated against growth of pathogenic fungi, them the petri dishes were incubated in incubator for five days. Lately the inhibition zone diameters were estimated for both pathogenic fungi isolates (11).

RESULTS AND DISCUSSION

The necessity and importance of investigation, estimation and evaluation of antimicrobial activity of any active chemical compound which was naturally isolated and identified or chemically synthesized come from the need to find different therapies for various diseases caused by pathogenic microorganisms such as fungi and bacteria . So various several researches were carried out to investigate, estimate and evaluate the antimicrobial activity for different drugs and active synthetic chemical compounds or active chemical constituents isolated, separated and identified from various herbs and medicinal plants leading to existence these therapies in the life of human being then protection of living organisms such as human and animal from exposure and infection with different biochemical disorders (12,13). The antimicrobial activity of acetyl salicylic acid as phenolic compound against growth of *Candida albicans* fungus is illustrated in the table (1).

Table (1): Results of antimicrobial activity of 5-methyl acetyl salicylic acid against *Candida albicans* fungus .

Pathogenic fungus species	5-methyl acetyl salicylic acid con.(mg/ml)	Inhibition zone diameters (mm)
Candida albicans	25	19
	50	21
	75	28
	100	29
	150	35
	170	40

It was noticed clearly that increase of phenlic carboxylic acid have been led to increase the inhibition zone diameters where the concentrations belonging to this compound represented by 25,50,75,100,150, and 170mg/ml recorded inhibition zone diameters equal to 19,21,28,29,35 and 40mm respectively this ensures that the increasing in concentration led to increase in antifungal activity. The explanation of this statement belong to ability of the concentrations to do the different biochemical disorders in the metabolism processes in the living cell of microorganism especially pathogenic fungi the capability of these living organism to resistance the biochemical effect of the phenolic carboxylic acid represented by methyl acetyl salicylic acid have become very weak because this acid destruct the fungal cell membrane and mitochondrial distributed in biological structure of the living cell of microorganisms and thus the render them was more than permeable (14,15).Active phenolic compounds have ability to destroy the chemical metabolism pathway for carbohydrates ,proteins, lipids and nucleic acid , also these chemical can end the biochemical roles of enzymes activity leading to stopping the all chemical reactions abundant in the metabolic pathways catalyzed by these various enzymes (16). The hydroxyl group (-OH) present in the phenolic acids which has chemical ability to bond with hydrogen atoms belonging to proteins existing in the living cell of microorganism than this bonding leads to break the sulphur and hydrogen bonds which are abundant in the tertiary structure of peptides and proteins which are present in the bacterial or fungal cell. Different studies indicated and showed the great capability of phenolic compounds in the process of destructing the cell wall leading to increase its permeability towards these active chemicals leading to happen the denaturation of various proteins in the living cell of pathogenic microorganisms especially fungi (16,17).

Various studies proved that phenolic compounds having hydroxyl groups inhibit the metabolic pathways of biochemical synthesis of nucleic acid (DNA & RNA) by bonding between the active phenolic group or hydroxyl group existing in phenolic compound with nitrogenous bases which are represented by adenine , thymine, cytosine, uracil and guanine abundant in the chemical structure of their acids leading to inhibit the biochemical role of DNA and RNA as important compounds for living cell action(18,19).

Estimation table (2) results of antimicrobial activity of 5- methyl acetyl salicylic acid against *Aspergillus* sp. Fungus. The biochemical effect in regard to antimicrobial activity 5- methyl acetyl salicylic acid against growth of pathogenic fungus represented by Aspergillus sp., was studies. Table (2) shows the inhibition zone diameters which were recorded from the action of this phenolic compound, where the concentrations represented by 25,50, 75,100,150 and 170 mg/ml recorded inhibition zone diameter equal to 15,23,28,30,40and 55mm respectively.

Table (2): Results of antimicrobial activity of 5- methyl acetyl salicylic acid against *Aspergillus* sp. Fungus.

Pathogenic fungus species	5- methyl acetyl salicylic acid con.(mg/ml)	inhibition zone diameter(mm)
Aspergillus sp.	25	15
	50	23
	75	28
	100	30
	150	40
	170	55

It was found that inhibition zone diameter recorded were increased with increase of concentration of 5-methyl acetyl salicylic acid and the higher value of inhibition diameter was 55mm at the highest concentration and this proves that the great concentration of phenolic carboxylic acid had the highest activity against growth of Aspergillus sp., so this means that this concentration have an excellent ability to inhibit or kill this pathogenic fungus.

Different biochemical mechanisms have explained the medicinal action of active phenolic compounds towards the different microorganisms including pathogenic fungi strains and one of these mechanisms is capability of phenols to destruct the living cell wall then increase of its permeability for these active chemical compounds leading to denaturant the proteins of pathogenic microbes cell. Several researches indicated the antifungal activity of phenolic compounds such as gallic acid, catechin, lutealin and quercetin against growth of different pathogenic fungi represented by *Candida* species such as *C. albicans, C. glabrata, C. parapsilosis and C. tropicalis* where the phenolic compound showed very good inhibition also the minimal inhibitory concentration value were significant. Also five active phenolic compounds are p- cumaric acid, ferulic acid, rutoside, quercetol and kaempferol extracted isolated from *Hedra belixl* flowers and fruits showed a good antifungal activity against growth of *Aspergillus niger, Botrytis cinerea, Penicillium gladioli and Sclerotinia sclerotiorum* fungi compared to antimycotic drug(20,21,22).

CONCLUSIONS

The phenolic carboxylic acid represented by 5-methyl acetyl salicylic acid has proved the great antimicrobial activity against both pathogenic fungi strains represent by *Candida albicans* and *Aspergillus* sp. Especially at the high concentrations belonging to this acid. Where these concentrations recorded significant inhibition zone diameters. So this phenolic acid can be carried out as a synthetic drug to treat various diseases caused by these pathogenic fungi instead of antibiotics but this research requires more clinical and pharmaceutical works.

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