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Antibacterial Screening of Some Newly Synthesized Cinnamo Hydroxamic Acids

Surendra K. Rajput*
Principal, V. Y. T. P. G. Autonomous College, Durg (C.G.), 492010, INDIA

Anita Patel
Department of chemistry,Govt. N. P.G. College of Science, Raipur, (C.G.) 492010, INDIA.

Kishor N. Bapat
Additional Director, Directorate of Higher Education Raipur (C.G), INDIA.

Abstract
Newly synthesized cinnamo hydroxamic acids (CHA), N-methyl cinnamo hydroxamic acid (MCHA), N-benzyl cinnamo hydroxamic acid (N-BCHA), p-methyl benzyl cinnamo hydroxamic acid (p-CH_3BCHA) and p-chloro benzyl cinnamo hydroxamic acid (p-ClBCHA), were synthesized and characterized by ^{1}HNMR, IR spectroscopy and elemental analysis. These compounds are shows bacteristatic and bactericidal properties by the interaction of bacterial cell wall with two process bacterial cell wall synthesis inhibitors and disruption of protein synthesis. The bacterial cell growth zone of inhibition by these compounds (CHA, MCHA, N-BCHA, p-CH_3BCHA, p-ClBCHA) for *Lactobacillus* are 13 mm, 17 mm, 14 mm, 15 mm, 22 mm and for *Escherichia coli* are 14 mm, 16 mm, 19 mm, 12 mm, 20 mm, at 1000 ppm respectively. Detailed analysis shows that these compounds are good cell growth of inhibition by the study of antibacterial activity against *Lactobacillus* and *Escherichia coli* bacteria.
Keywords: Cinnamo hydroxamic acids, Antibacterial, Inhibition, Bacterial, Activity.

1. Introduction

Hydroxamic acids refer to a class of chemical organic compounds having formula RC (=O) NR'OH in which hydroxylamine is inserted in to a carboxylic acids with 'R' as an organic residue (alkyl or aryl group), a CO as a carbonyl group, and a hydroxylamine as NH_2-OH [1][Figure 1].

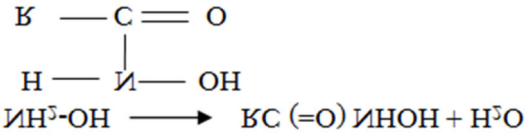

Figure1. General structure of hydroxamic acid, where R as an alkyl and aryl group.

The subject of this research is to study the antibacterial activity of synthesized cinnamo hydroxamic acids against *Lactobacillus* and *Escherichia coli.* *Lactobacillus* may also cause arthritis, bloating, blockage of a lung artery, diarrhea, disease of the esophagus, heart inflammation, liver infection, skin reactions, stomach cramping, stomach lining inflammation, stomach rumbling, and vaginal burning and discomfort[2]. *Escherichia coli*, usually called *E. Coli*, refers to a large group of bacteria that is commonly found in the intestines of humans and animals, Escherichia coli may also causing severe stomach cramps, diarrhea and vomiting [3]. Cinnamo hydroxamic acids are commonly synthesized by acylation of hydroxylamine and cinnamoyl chloride [4] .When a hydroxamic acid has got achieved then it got gift to many fields like – pharmaceutical[5], medicinal biological[6], medical molecular modeling[7], analytical[8] and nuclear chemistry[9], as well as their role as antibacterial [10], antifungal[11], antitumor[12] and anti-inflammatory activities[13]. One of the most important activity of cinnamo hydroxamic acids are ability to inhibit various enzyme viz- peroxidase[14], urease[15] or ribonucleotide reductase[16], metalloproteinase[17] and hydrolases[18]. Mechanism of enzyme inhibition for cinnamo hydroxamic acids by electophilic character, the electrophilicity allows the molecule to react with nucleophilic center present in enzyme involved in bacterial cell wall [19]. In view of the above application, the present work relates to the synthesis and characterization of cinnamo hydroxamic acids such as cinnamo hydroxamic acids (CHA), N-methyl cinnamo hydroxamic acid (MCHA), N-benzyl cinnamo hydroxamic acid (N-BCHA), p-methyl benzyl cinnamo hydroxamic acid (p-CH_3BCHA), p-chloro benzyl cinnamo hydroxamic acid (p-ClBCHA), and reports the results of the undertaken antibacterial evaluation against *Lactobacillus* and *Escherichia coli.*

2. Materials and instrumentation

All reagents and chemicals were purchased from Sigma Aldrich and Merck products used. Cinnamo hydroxamic acids were synthesized and purified according to the literature procedure. All the glass wares were cleaned with chromic acids cleaning solution followed by distilled water. These were then sterilized and stored in dust proof

cabinets. The bacterial cultures *Lactobacillus and Escherichia coli* used were 5-7 days olds. For the preparation of standard nutrient agar medium beef extract 3 gm, peptone 5 gm, agar-agar 15 gm, NaCl 5gm, congored 2.5ml and distilled water 1000ml was used for determination of antibacterial activity.

2.1 Preparation of media

Beef extract 3 gm, peptone 5 gm, agar-agar 15 gm, NaCl 5gm, congored 2.5ml are mixed and boiled in 500 ml distilled water for one hour filtered and volume made to 1000 ml by distilled water. The medium was auto claved at prior half an hour [20].

2.2 Preparation of bio disc

Preparation of biodisc, multiple layers of whatman filter paper (no.42) carefully cut in 1cm diameter are used and prepared of the above five synthesized cinnamo hydroxamic acid derivatives in the concentration level of 1000 µg/ml using DMSO (di methyl sulphoxide) [21].

2.3 Preparation of standard solution

The antibacterial activity of each compound was evaluated at 1000_{ppm}, $100_{ppm,}$ $10_{ppm,}$ concentrations. Three solution of different concentration with media (1000_{ppm}, $100_{ppm,}$ $10_{ppm,}$) were prepared with the help of the following equation making use of stock solution [22].

$$\text{Desired ppm} = \frac{\text{Stock Solution in ppm} \times X}{V}$$

Where, X= volume of stock solution (in ml added)

V= volume of media

2.4 Procedure for Antibacterial activity

Newly prepared compounds were screened for their activity against *Lactobacillus and Escherichia coli* in DMSO by paper disk diffusion method the prepared 50 ml nutrient ager medium (NAM) taken in a number of 100 ml conical flask were plugged with cotton autoclaved for half an hour at 20 psi pressure. Normal saline was used to make a suspension of spore of fungal strain was transferred to 30 ml saline to get a suspension of corresponding species. Agar media (20 ml) were powered in to each species. Excess of suspension was decanted and plates were dried by placing in incubation at 72 hrs at 28± ^{o}C in culture room. The testing was repeated three times for each concentration of the compound under investigations, along with affair number of replicates of the control plates [23].

3. Result and discussion

Activities of each compound were observed and compared with tetracycline used as standard drugs. The bacterial colony diameter was measured at 24, 48 and 72 hrs in three diameters by millimeter scale. The diameters were marked by pencil for subsequent identification. The inhibition of the bacterial growth was determined as the difference in growth between test and control plates (Table. 1). The percentage inhibition in colony of the test bacteria was expressed as:-

$$\% \text{ Inhibition} = \frac{(C-T) \times 100}{C}$$

Where, C= Diameter of fungus colony (mm) in controls plates.

T= Diameter of fungus colony (mm) in test plates

3.1 Zone of inhibition of Lactobacillus and

The synthesized compounds and the reference drugs were screened under identical conditions and the zone of inhibition was measured in mm. The study of antibacterial activity showed that p-ClBCHA was highly sensitive for *Lactobacillus* against cinnano hydroxamic acids (CHA), N-methyl cinnamo hydroxamic acid (MCHA), N-benzyl cinnamo hydroxamic acid (N-BCHA) and p-methyl benzyl cinnamo hydroxamic acid (p-CH_3BCHA), derivatives of hydroxamic acids (Table 1).

3.2 Zone of inhibition of E. coli

The synthesized compounds and the reference drugs were screened under identical conditions and the zone of inhibition was measured in mm. The study of antibacterial activity showed that p-ClBCHA was also highly sensitive for *Escherichia coli* against cinnamo hydroxamic acids (CHA), N-methyl cinnamo hydroxamic acid (MCHA), N-benzyl cinnamo hydroxamic acid (N-BCHA) and p-methyl benzyl cinnamo hydroxamic acid (p-

CH_3BCHA), derivatives of hydroxamic acids (Table 1).

4. Conclusion

In this work, the method used for the synthesis of final compounds in the manuscript is very useful in various field of analytical, pharmaceutical, medical molecular modeling, docking and nuclear chemistry. The compounds are very big antibacterial activity and are selective inhibitors of various enzymes. The antibacterial screening data showed a moderate to good activity at higher concentration but bacteriocity decreases considerably upon dilution p-ClBCHA are more toxic to *Lactobacillus and Escherichia coli* (Table-2), The sequence of antibacterial activity of these compounds for *Lactobacillus* are p-ClBCHA>MCHA>p-CH_3BCHA>N-BCHA>CHA and for *Escherichia coli* p-ClBCHA>N-BCHA> MCHA>CHA>p-CH_3BCHA at higher concentration 1000pm respectively (Figure 2).

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Table-1. Following compounds have been evaluated for their antibacterial activity .

S. No.	Name of compound	Average percentage inhibition after organism *Lactobacillus* concentration used			Average percentage inhibition after organism *Escherichia coli* Concentration used		
		1000_{ppm}	100_{ppm}	10_{ppm}	1000_{ppm}	100_{ppm}	10_{ppm}
1.	CHA	13	11	9	14	11	8
2.	MCHA	17	15	12	16	15	13
3.	N-BCHA	14	12	11	19	16	14
4.	p-CH_3BCHA	15	13	10	12	10	9
5.	p-ClBCHA	22	18	16	20	17	15
6.	Tetracycline(Standard)	55	50	32	44	39	31

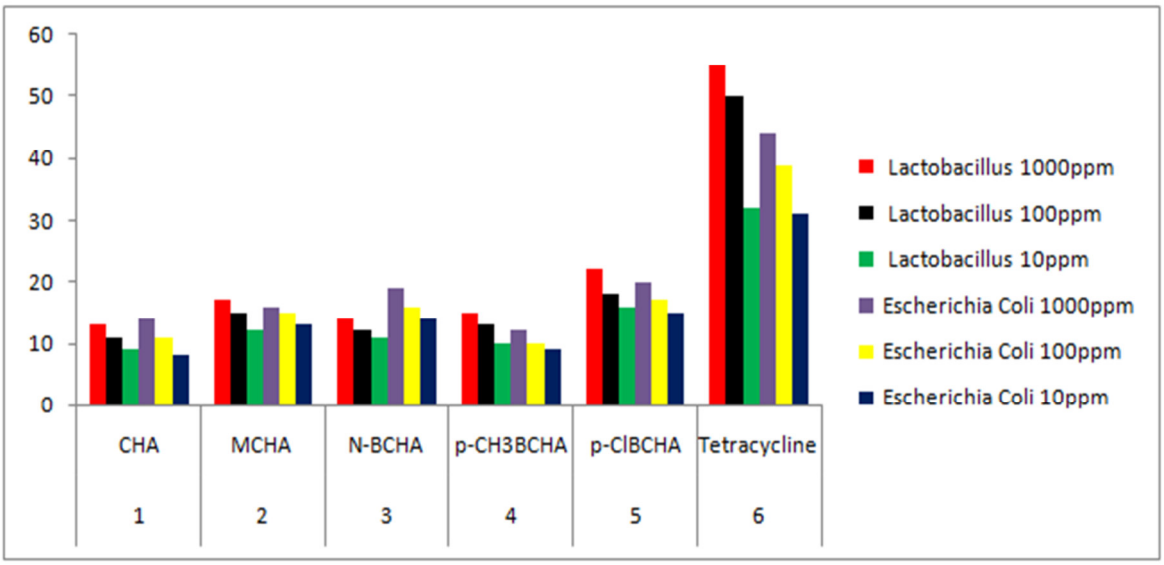

Figure 2. Cinnamo hydroxamic acid derivatives compound have been evaluated for their antibacterial activity against Lactobacillus and *Escherichia coli.*