

TO COMBAT ANTIBIOTIC RESISTANCE – BY EXPLORING NATURAL ANTIBIOTICS

Rajeswari Saripilli^{*1} and Pikkala Shirisha²¹Maharajah's College of Pharmacy, Phool Baugh, Vizianagaram- 535002, India²Tata Consultancy services, Hyderabad, India**ABSTRACT**

Antibiotic resistance develops in no time and is a big matter to concern, it possess a serious global threat of growing concern to human, animal and environmental health. The main reason of antibiotic resistance is emergence, spread and persistence of multi-drug resistant. Once resistance developed, the usage of antibiotics will no longer has effect on our body and leads to serious complications like toxicity, dose dumping etc., so the different strategies to combat the antibiotic resistance are establishing natural antibiotic resources. Nature is a generous source of compounds which is having the potential to treat diseases including infectious diseases. Spices like turmeric, ginger, alliums are indispensable for the preparation of our daily food and are reported to possess compounds, which have varied beneficial biological effects and also prevent the microbial spoilage of food. The present research work was aimed to take different natural resources and the chosen resources are turmeric, garlic and ginger. Different extraction processes are performed and the obtained extract of pure natural polymers and also evaluated for antibiotic activity. The antibiotic activity of all the species were found to be in the order of garlic, ginger and turmeric. The study indicates that the selected species have antibiotic activity. The further studies are needed to study the activity with different concentrations of the selected polymer and hence, suitability can be a hope in replacing the synthetic antibiotics, which will be very much useful for combating antibiotic resistance.

Keywords: Antibiotics, Natural antibiotics, Ginger, Garlic, Turmeric, Resistance.

INTRODUCTION

The ability of the microorganisms to resist the effect of an antibiotic to which once they are sensitive is called antibiotic resistance. It is also known as drug resistance. Resistance to antibiotics develops in no time and it is a big matter to concern. This poses a serious global threat of growing concern to human, animal and environmental health. This is due to the emergence, spread, and persistence of multidrug- resistant. This global antibiotic resistance shows no signs of decline¹, though it may perhaps shift direction. Once if the resistance is developed the usage of the antibiotic has no further effect on the body and this will lead to dose dumping, toxicity, etc. Antibiotic resistance is increasing at an alarming² rate. Non-judicial use of antibiotics is mostly responsible for making the microbes resistant. A growing list of infections like pneumonia, tuberculosis, and gonorrhea are becoming harder and at times impossible to treat while antibiotics are becoming less effective. Antibiotic- resistant infections correlate with the level of antibiotic consumption. The effective use of an antimicrobial agent is undermined due to the possible tolerance or resistance developed from the very initial time the compound is used. This is true for the antimicrobial agents used to treat bacterial, viral, fungal and parasitic infections. The defining moment in the history of mankind that revolutionized medicine and saved countless lives, is the discovery of the antibiotics. Unfortunately these magic bullets have been a global concern due to the increasing resistance on the long term usage of them.

Origin of Antibiotic Resistance: It occurs when drug molecule loses its ability to inhibit the bacterial growth. This will lead to multiplying of the bacteria even in the presence of the antibiotics. Such bacteria which replicates even in the presence of the antibiotics are called as resistant bacteria.

Strategies to Combat Antibiotic Resistance: The different strategies to combat antibiotic resistance and also to minimise the inappropriate use of antibiotics. Prevent the usage of multiple antibiotics at a time. Implementation of natural antibiotics will pave way for overcoming the antibiotic resistance and also will improve the wellbeing of human's. In our present research work different natural resources are taken and studied for the presence of the antibiotic activity, and ciprofloxacin antibiotic is taken as a standard in order to observe the antibiotic activity of the natural resources.

MATERIAL AND METHODS

The natural resources which are taken for this study are turmeric, ginger and garlic. Various extraction processes are performed and the obtained extract is evaluated for the presence of the antibiotic activity, by performing antibiotic sensitivity test. Turmeric, ginger and garlic are purchased from the local market.

Method of Extraction

Extraction process of turmeric: About 100 gm of dry spices were crushed and sieved to get fine powder, powdered spices are soaked in 200 mL distilled water and kept at room temperature for 24 hours, after 24 hours it was filtered using whatman No. 1 filter paper, filtrate was heated at 40-50 °C using water bath, until thick paste is formed, the thick paste was considered as 100 % concentration of the extract³. The extract is stored at 4 °C in refrigerator. Extracts were diluted to make different concentrations such as 80 %, 60 %, 40 %, 20 % and 10 %, by mixing with appropriate volumes of distilled water. The extraction process of turmeric is represented in Fig.No.1.

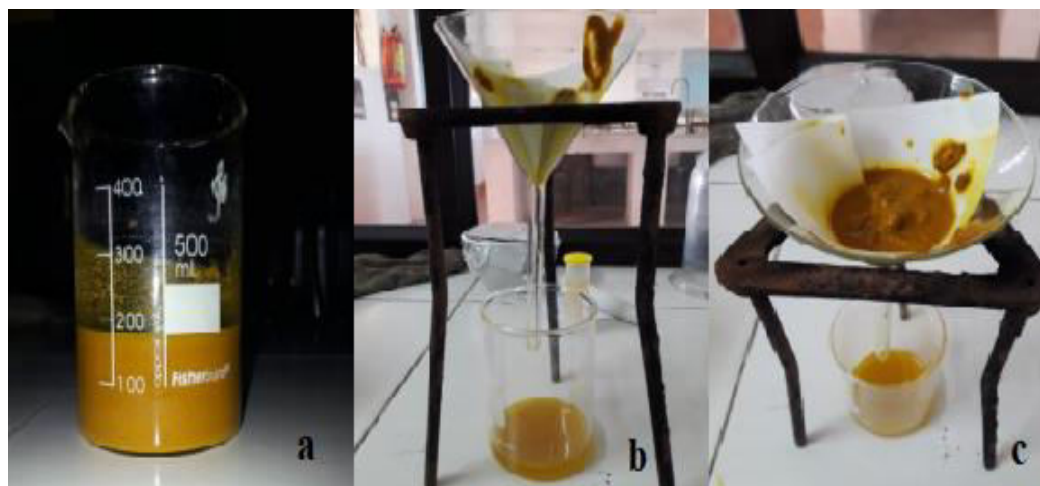


Fig. No. 1: Extraction process of turmeric (a) Maceration of turmeric, (b) Filtration, (c) Obtained turmeric paste.

Extraction Process of Garlic: Plant material was washed with clean water and allowed to air dry, outer covering is manually peeled off and materials are sliced into cutlets, materials are placed in hot air oven for drying at 65 °C for 72 hours, using blender the plant cutlets were pulverised into powder. The obtained powder is passed through sieve number # 60 and stored for future use, 25 gm of powdered plant material was dissolved in enough sterilized 95 % ethanol to make 100 mL of ethanol extract, the mixture is kept undisturbed at room temperature for 24 hours in flask and covered with aluminium foil, subjected to filtration through whatman No.1 filter paper, after filtration the extract was evaporated in water bath until 25 mL extract was left in the container⁴. Obtained extract is 100 % concentrate and further concentrations are prepared by diluting with 95 % ethanol. The extraction process of garlic is represented in the Fig.No.2.



Fig. No. 2: Extraction process of garlic (a) Garlic bulbs, (b) Obtained garlic powder.

Extraction process of ginger: Plant material was washed with water and allowed to air dry, outer covering is manually peeled off and materials are sliced into cutlets, Material is placed in hot air oven for drying at 65 °C for 48 hours. Using blender the plant cutlets were pulverised into powder. The obtained powder is passed through sieve number #60 and stored for future use. About 12.5 gm of powdered material is soaked with 50 mL ethanol for 24 hours at room temperature, resulting extract was filtered through whatman No.1 filter paper⁵. The filtrate obtained was evaporated to dryness by placing in hot air oven at 40 °C for 24 hours. The precipitate that is obtained is made to 1000 mg/mL concentration. Then diluted in ethanol in different concentrations 10, 20, 30, 40, 50, 60 µg/mL. The extraction process of ginger is represented in the Fig.No.3.



Fig. No. 3: Extraction process of ginger (a) Ginger cutlets, (b) Obtained ginger powder, (c) Extract obtained.

Antibiotic Sensitivity Test: It is a laboratory procedure which is performed to identify which Antimicrobial regimen is specifically effective over microorganisms. This includes disk-diffusion and minimum inhibitory concentration (MIC) methods. The antibiotic sensitivity test is performed on *Escherichia. coli* (E. coli) and *Pseudomonas. aeruginosa* (PAE) species by using ginger, turmeric and garlic along with ciprofloxacin antibiotic. This test confirms the antibacterial activity of the natural source⁴⁻⁶.

Procedure: Standardized inoculum is prepared from a bacterial culture. Nutrient agar medium is prepared and sterilized in the autoclave, once it attains room temperature inoculum is taken and inoculated in it and it is poured into the petri plate and once it is well settled, with a cork borer holes are punched in order to fill with antibacterial solution. Under sterilisation area, one drop of solution of different natural sources and ciprofloxacin antibiotic are filled and kept undisturbed in incubator for about 24 hours.

Results and Discussion

The selected natural sources, showed their effect against bacteria providing antibacterial effect against *Escherichia. coli* (E. coli) and *Pseudomonas. aeruginosa* (PAE) species were carried in this present research work and the results were discussed below:

Antibiotic sensitivity test: In the present investigation, the antibiotic chosen is ciprofloxacin and the natural sources that are chosen are garlic, turmeric and ginger which are extracted and performed antibiotic sensitivity test to confirm the antibiotic activity of the natural source. The natural source that is having the antibiotic activity will be considered and the formulation of the ciprofloxacin with the natural source will be performed and evaluated. The antibiotic sensitivity test was performed for all the three extracted natural sources that are garlic, turmeric and ginger, against E.coli and PAE species and evaluated for the antibiotic activity. The antibiotic activity of the garlic, ginger and turmeric are compared with that of ciprofloxacin. The minimum inhibitory concentration of the three natural sources, along with ciprofloxacin in different concentrations is given in the **Table No.1**.

Table No. 1: Minimum inhibitory concentration values.

Specimen	Concentration (µg/ml)	E.coli (mm)	PAE (mm)
Garlic	10	15	17
	20	18	18
	40	22	22
Ginger	10	10	12
	20	11	14
	40	11	14
Turmeric	100	10	10
	200	10	10
	400	10	11
Ciprofloxacin	10	21	24
	20	25	26
	40	28	30

Antibiotic Sensitivity Test Results: The pictorial representation of the inhibition zones of ginger, turmeric, garlic and ciprofloxacin against E.Coli organism are represented in the **Fig.No.4**.

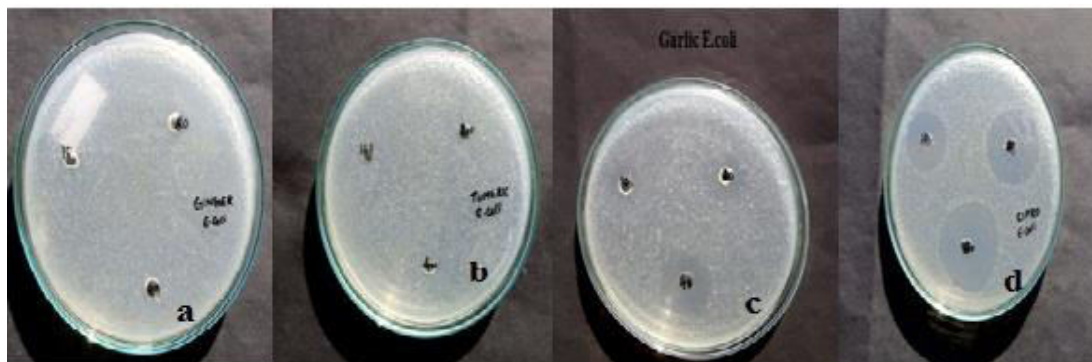


Fig. No. 4: Antibiotic sensitivity results of a) Ginger against E.Coli, b) Tumeric against E.Coli, c) Garlic against E.Coli and d) Ciprofloxacin against E.Coli.

CONCLUSION

From the above results, garlic has shown antibiotic activity and it is almost similar to that of ciprofloxacin. So as it is a natural resource, there is a possibility in incorporating with synthetic antibiotic in order to reduce the dose and also to prevent the antibiotic resistance. So further studies are required in developing a new formulation, which involves incorporation of natural antibiotic with the synthetic antibiotic.

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