CHAPTER - 2

NATURE AND SCOPE OF INVESTIGATION

The discovery of antibiotics created a new era in the treatment of infectious diseases, but bacterial evolutionary responses to the antibiotics, resulted in the development of bacterial strains resistant to antibiotics. The continuous exposure of bacteria to antimicrobial agents induces the development of resistance, which results in multiplication and spread of resistant strains (Hayward and Griffin, 1995). Many strains of *Staphylococcus aureus* are already resistant to several antibiotics. There are reports of clinical isolates methicillin-resistant *Staphylococcus aureus* exhibiting resistance to mupirocin (Poupard, 1995). Most strains of *Shigella* species prevalent in India now are resistant to chloramphenicol, streptomycin, sulphonamides etc. *Klebsiella pneumoniae* is a frequent cause of urinary infections and exhibit resistance to various antibiotics.

Food preservation is the important aspect of human concern to provide microbiologically stable foods. It is achieved by controlling the growth of spoiling and pathogenic food related microorganisms. The problem of food preservation has grown to be more complex as new food products are frequently being introduced on the market, requiring longer shelf life and greater assurance of protection from microbial spoilage and food-borne diseases (Farag et al., 1989 b).

There are several chemicals that can be used as antimicrobial agents. For instance, acetic acid, sulfur dioxide, hydrogen peroxide, chelators, are widely used as food preservatives (Farag et al., 1989 b; Brull and Coote, 1999). However, these
chemicals require caution in handing. The synthetic chemicals convert some ingested materials into toxic substances or carcinogens (Farag et al. 1989 b).

Uncontrolled use of chemical antimicrobial preservatives has been the main factor for appearance of microbial strains more and more resistant to classical antimicrobial agents. Fifty years of increasing use of chemical antimicrobials have created a situation leading to an ecological imbalance and enrichment of multiresistant pathogenic microorganisms (Leavy, 1997). The success of chemotherapy lies in the continuous search for new drugs to counter the challenge posed by resistant strains (Notermans and Hoogenboon-Verdegaal, 1992). The Brull and Coote (1999) reported microbial resistance to some antimicrobials used in food preservation. Consequently, alternative preservatives are needed which possess antimicrobial activity but cause no health problems to the handler and consumer.

Fungal infections have increased in frequency in last two decades, especially involving immunocompromised patients. Candidal infections are commonly seen in compromised patients and manifest both as superficial and systemic diseases (Beck-Sague & Jarvis, 1993). Invasive fungal infections can be life-threatening (Nagiec et al., 1997) for patients such as neonates, cancer patients, organ transplant patients, burn patients and AIDS patients. In addition, an increasing number of normal individuals, including children in the third world-nations (Freixa et al., 1998) that suffers from poor sanitation and educations have fungal infections. Dermatophytic fungal diseases are predominant in tropical and subtropical countries due to prevailing moisture and temperature regimes (Jain & Sharma, 2003).
Many drugs are available for the treatment of fungal infections, but there are infact a limited number of efficacious antifungal drugs. Many of the drugs currently available have undesirable side effects or are very toxic, are fungistatic and not fungicidal or lead to the development of resistance (White et al., 1998). Ideal drug to cure fungal infections have not been discovered yet (Polak, 1999). Due to various side effects, long duration of treatment and high cost of drugs, treatments have not been successful in some cases (Jain & Sharma, 2003).

Resistance to currently available antifungal drugs continues to grow (Bartroli et al., 1998). Antifungal drug resistance and emergence of novel species have also contributed to the drastic increase in fungal infections (Coleman et al., 1998). There is a real need for a next generation of safer, effective, and more potent antifungal agents (Bartroli et al. 1998).

In recent years, there has been a gradual revival of interest in the use of medicinal plants in developed as well as developing countries, because herbal products have been reported to be safe and without any adverse side effect. Thus searches for new antimicrobial with better and cheaper substitutes from plant resources are a natural choice (Jain and Sharma, 2003).

Plant products with antimicrobial properties have received attention for a possible application in food preservation and health care system. Moreover plant products have been generally recognized as safe (GRAS) (Newberne et al., 2000; ICMR Bulletin, 2003) and some of them have been reported to have antimicrobial properties (Cowan, 1999).
Spices, the natural medicinal plants have been reported to have antimicrobial activity and can serve as powerful natural drugs like antibiotics, carminatives, antidepressants, analgesics, tranquilizers, cholesterol reducers, antihypertensive, diuretics, anti-inflammatory agents and so on (Bakhru, 2004; Pruthi, 1976). The preservative action of herbs and spices has received great attention (Azzouz and Bullerman, 1982; Farag et al, 1989 b).

Antimicrobial activity of extracts and essential oils from spices has been reported by several workers (Meena & Sethi, 1994; Arora and Kaur, 1999). Many essential oils have been advocated for use in complementary medicine for bacterial and fungal infections (Hammer et al, 1998). Moreover the majority of the essential oils are classified as Generally Recognized As Safe (GRAS)(Kabara, 1991).

Looking at the several factors such as developing drug resistance among microorganism, undesirable effects of currently available drugs, need for alternative safer, cheaper and effective antimicrobial agents for therapeutic management of bacterial & fungal infections, necessity of alternative food preservative and promising results shown by spices and herbs on antimicrobial activity, the study was undertaken to evaluate the antimicrobial potential of spice extracts and essential oils.

Aqueous extracts and essential oils of various spices were screened rapidly for antimicrobial and antifungal activities by well and disc diffusion methods. Spice essential oils with potent antimicrobial activities were tested for antifungal properties by broth macrodilution and microdilution methods using clinical yeast isolates. A variety of spice essential oil combinations were also tested for synergistic properties.

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