Chapter 9
Phytochemicals:
Their Therapeutic Potential Against Dental Caries

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ABSTRACT

The chapter gives a picture of the current data on the available anticariogenic natural products and their mechanism of action. Different phytochemicals such as phenols, flavanoids, alkaloids, terpenoids, tannins, lectins, etc. and their anticariogenic efficacy have been discussed in detail. All the data emphasise the fact that the use of natural products is emerging as an effective strategy in the prevention and treatment of dental caries. Consequently, these natural products could be incorporated in toothpastes and other oral hygiene products to promote oral health.

INTRODUCTION

Dental caries can be defined as a multistep process involving demineralization and remineralisation rather than unidirectional demineralization (Robinson et al., 1998). In spite of the global claims of success in treating this disease, it still haunts most of the world's population (Mandel, 1993; Stephen, 1993). Although according to Glass (1982), a decline in its prevalence has been witnessed in some populations of the developed countries, the level has been exaggerated (NIH, 1987, 1989). An NIH survey (1989) claims that 50% of 12 year old children of US are free from tooth decay. However, according to the survey, deciduous teeth were not examined and 85% of the 17 year old children had one or more carious teeth. The mean value which gives the percentage of caries free children itself is not reliable since the data were not normally distributed (Edelstein and Douglass, 1995). Even if it is considered true, 50% of the population have dental caries.

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The most important treatment strategy for dental caries is the reduction and/or elimination of bacterial accumulations on the tooth surface and between teeth by brushing teeth regularly and frequent dental cleanings (Loesch and Grossman, 2001). Antibacterial mouth rinses which generally contain fluorides, alcohols, detergents and other antimicrobial substances effectively reduce the plaque formation. Synthetic antimicrobials used in tooth pastes and mouth rinses include povidone iodine products, chlorhexidine, cetylpyridinium chloride, triclosan and zinc citrate. However, these substances cause unwarranted undesirable effects like vomiting, diarrhea and teeth staining. There is also a problem of development of antimicrobial resistant strains with the use of these synthetic antimicrobials. These adverse consequences have led to the development of natural antimicrobial agents which are being incorporated in tooth pastes and mouth rinses (Cai and Wu, 1996). Some popular examples include miswak, tea tree oil, peppermint, green tea and manuka honey.

WORLD SCENARIO

Around 250,000 to 500,000 species of plants have been reported on earth of which relatively a small percentage (1 to 10%) is used as food by humans and other animals Borris, 1996). It is possible that even more are used for medicinal purposes (Moerman, 1996). Natural products are being used to treat many diseases since time immemorial wing to their anti bacterial, anti inflammatory, cytostatic (Wu-Yuan et al., 1990), antifungal and anti viral activities. According to WHO, 80% of the population of developing countries exclusively use traditional medicine (Eloff, 1998; Nascimento et al., 2000).

It has been well documented that medicinal plants confer considerable antibacterial activity against various microorganisms including bacteria responsible for dental caries (Jonathan et al., 2000). Compelling evidences show that a variety of plant products have the potential to control dental caries (Onishi et al., 1981; Kashket et al., 1985; Kakiuchi et al., 1986; Hada et al., 1989; Sakanaka et al., 1989; Kubo et al., 1992; Nakahara et al., 1993). The anticariogenic activity of many of the plant products can be attributed to their rich polyphenolic content (Ito et al., 1984; Kakiuchi et al., 1986; Sawamura et al., 1992; Tagashira et al., 1997; Mitsunaga and Abe, 1997). Drinking green tea extracts after every meal is a well known Japanese custom. The anticaries effect of this polyphenol rich source was investigated by several researchers (Hattori et al., 1990; Sakanaka et al., 1989, 1990, 1992; Otake et al., 1991; Nakahara et al., 1993; Ooshima et al., 1993, 1994, 1998). The polyphenols in tea extract comprise catechin, epicatechin, gallocatechin, epigallocatechin, epicatechin gallate, epigallocatechin gallate, etc. which are found to inhibit the primary cariogenic agent, *S. mutans* (Otake et al., 1991). They also prevent caries formation by inhibition of bacterial adherence, acid production, and glucosyl transferase activity (which is involved in extracellular polysaccharide formation). Some combinations of Oolong tea monomeric polyphenols showed the highest level of antibacterial activity. These results suggest that the antibacterial activity of oolong tea extract is caused by a synergistic effect of monomeric polyphenols, which can easily bind to proteins (Sasaki et al., 2004). The growth of many oral bacteria was found to be inhibited by spice extracts like C*innamon bark* oil, *Papua mace* extract and C*love bud* oil (Saeki et al., 1989). *Sanguinaria,* an alkaloid extract from the rhizome of *Sanguinaria canadensis* has been found to show broad antibacterial activity against cariogenic bacteria (Joann et al., 1985). The antibacterial activity of some plant species like *Melia azadirachta, Calotropis gigantean, Leucas aspera, Vitex negundo* and others have been extensively investigated (Rao, 2000). Manuka (honey derived from the flowers of the manuka tree in NewZealand), tea tree, eucalyptus, lavandula and rosmarinus (rosemary) oils have been shown to