

Effects of mushroom on dental caries

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ABSTRACT

One of the oral health problems which affects 60–90% of schoolchildren and majority of adults, is dental caries (tooth decay) which in fact is an infectious microbiologic disease of the teeth leading to localized dissolution and destruction of the calcified tissues. It can also be considered as one of the most common chronic diseases in the world. Nowadays, due to particular modifications in diets, there has been an increase in the prevalence of dental caries. However, evidence suggests the opposite. In developed countries, there is a notable decrease in dental caries in certain populations especially in the United States, Western Europe, New Zealand, and Australia. Hence, the review is aimed to focus on the pharmacological aspects of mushroom on dental caries.

Keywords: Dental caries, oral health problem, calcified bones, pharmacological

Introduction

Dental caries are caused by the action of acids on the enamel surface. The acid is produced when sugars (mainly sucrose) in foods or drinks react with bacteria present in the dental biofilm (plaque) on the tooth surface. The acid produced leads to a loss of calcium and phosphate from the enamel; this process is called demineralization. Saliva acts to dilute and neutralize the acid, which causes demineralization and is an important natural defense against caries.^[1]

Aside from buffering plaque acids and halting the demineralization of enamel, saliva provides a reservoir of minerals adjacent to the enamel from which it can remineralize and “heal” once the acids have been neutralized. The enamel demineralizes and remineralizes many times during the course of a day. It is when this balance is upset and demineralization exceeds remineralization that caries progresses. This leads to a break down in the enamel surface, leading to the formation of a cavity in the tooth.^[2]

Therefore, to prevent caries, many methods have been generated. The most commonly used method is the use of fluoride as an anticariogenic agent,^[3] but it has cytotoxic effects if it exceeds a concentration over 80 ppm.^[4] Recently, scientist has gone into research of natural methods for caries control.^[5-9] Functional foods like mushroom have a wide range of biomolecules with nutritional^[10] and medicinal substances^[11-13] with immunomodulatory, cardiovascular, liver protective, antifibrotic, anti-inflammatory, antidiabetic, and antimicrobial properties.^[14-18] In this literature, the anticariogenic effects of consuming mushroom are reviewed [Figures 1 and 2].

Effect of Mushroom

Streptococcus mutans and *Streptococcus sobrinus* are considered to be the main etiological agents due to effective colonization on the dental surface, carbohydrate metabolism, and lactic acid generation. Initially, several interactions occur between adhesion produced by the bacteria with glycoproteins on of the acquired pellicle on the teeth surface.

Then, due to the production of exopolysaccharides (glucans) from sucrose metabolism, bacteria will adhere tightly to the tooth surface. In case dental plaque is allowed to accumulate, *S. mutans* will adhere tightly and produce large quantities of lactic acid and cause dissolution of the hard substance of tooth.

Mushroom contains erythritol which is 1,2 and 3,4-butanetetrol which has 70–80% sweetness to that of sucrose. It is classified as a noncariogenic sweetener based on a study done. It showed that

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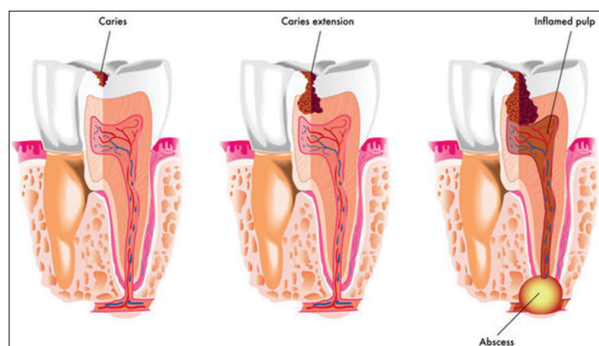


Figure 1: Tooth decay



Figure 2: Mushroom Toothpaste

S. mutans and *S. sobrinus* showed no adherence to glass in the presence of erythritol which suggests that erythritol is a sugar not used by these bacteria so the synthesis of glucans. Since it is not used by these bacteria, the byproduct lactic acid is not produced.^[19]

In a separate study by Daglia *et al.*, in 2011, the low molecular mass (LMM) fraction of extracts from an edible mushroom called Shiitake mushroom (*Lentinus edodes*) was identified with antiplaque activities. These LMM compounds are mainly secondary metabolites such as sesquiterpenes and other terpenes, steroids, and benzoic acid derivatives.^[20,21] High molecular mass compounds are mostly peptides and proteins. The study shows that LMM fractions of Shiitake mushrooms with a minimal of 2× concentrations are able to inhibit the growth of *S. mutans*.

This proves bacteriostatic action of Shiitake mushrooms by inhibition of DNA synthesis. This bacteriostatic action is also confirmed by morphological effects by the LMM fractions which show elongation of the bacteria with interrupted septa. The morphogenetic effects induced by the mushroom show similarities to those observed in streptococcal thermosensitive temperature or exposed to inhibitory doses of B-lactam antibiotics.^[12,22]

In another study by Gazzani *et al.*, in 2011, it was seen that both low as well as high molecular mass fractions cause inhibition of *S. mutans* adherence to hydroxyapatite crystals, promoted detachment of the bacteria from hydroxyapatite crystals, and induced biofilm destruction.^[23] It suggested that the component adenosine from mushroom was able to inhibit biofilm formation.

Conclusion

This literature reviews the positive effect of mushroom on preventing dental caries. Mushroom and its extracts can be very useful for caries prevention by incorporating in daily diet, especially in well-developed countries where it can replace the use of commercially available products.

References

- Glass RL. The first international conference on the declining prevalence of dental caries. *J Dent Res* 1982;61:1301.
- Yang JN. Effect of Mushrooms on Dental Caries. *J Pharm Sci Res* 2013;5:284-6.
- Guha-Chowdhury N, Iwami Y, Yamada T, Pearce EI. The effect of fluorhydroxyapatite-derived fluoride on acid production by streptococci. *J Dent Res* 1995;74:1618-24.
- Jeng JH, Hsieh CC, Lan WH, Chang MC, Lin SK, Hahn LJ, *et al.* Cytotoxicity of sodium fluoride on human oral mucosal fibroblasts and its mechanisms. *Cell Biol Toxicol* 1998;14:383-9.
- Matsumoto-Nakano M, Nagayama K, Kitagori H, Fujita K, Inagaki S, Takashima Y, *et al.* Inhibitory effects of *Oenothera biennis* (evening primrose) seed extract on *Streptococcus mutans* and *S. mutans*-induced dental caries in rats. *Caries Res* 2011;45:56-63.
- Marsh PD. Microbiological aspects of the chemical control of plaque and gingivitis. *J Dent Res* 1992;71:1431-8.
- Namba T, Tsunozuka M, Hattori M. Dental caries prevention by traditional Chinese medicines. Part II. Potent antibacterial action of Magnoliae cortex extracts against *Streptococcus mutans*. *Planta Med* 1982;44:100-6.
- Shouji N, Takada K, Fukushima K, Hirasawa M. Anticaries effect of a component from shiitake (an edible mushroom). *Caries Res* 2000;34:94-8.
- Wennström J, Lindhe J. Some effects of a Sanguinarine-containing mouthrinse on developing plaque and gingivitis. *J Clin Periodontol* 1985;12:867-72.
- Kalac P. Chemical composition and nutritional value of European species of wild growing mushrooms: A review. *Food Chem* 2009;113:9-16.
- Borchers AT, Keen CL, Gershwin ME. Mushrooms, tumors, and immunity: An update. *Exp Biol Med* (Maywood) 2004;229:393-406.
- Lindequist U, Niedermeyer TH, Jülich WD. The pharmacological potential of mushrooms. *Evid Based Complement Alternat Med* 2005;2:285-99.
- Poucheret P, Fons F, Rapior S. Biological and pharmacological activity of higher fungi: 20-Year retrospective analysis. *Mycologie* 2006;27:311-33.
- Zaidman BZ, Yassin M, Mahajna J, Wasser SP. Medicinal mushroom modulators of molecular targets as cancer therapeutics. *Appl Microbiol Biotechnol* 2005;67:453-68.
- Moradali MF, Mostafavi H, Ghods S, Hedjaroude GA. Immunomodulating and anticancer agents in the realm of macrofungi (macrofungi). *Int Immunopharmacol* 2007;7:701-24.
- Zhang M, Cui SW, Cheung PCK, Wang Q. Antitumor polysaccharides from mushrooms: A review on their isolation process, structural characteristics and antitumor activity. *Trends Food Sci Technol* 2007;15:4-19.
- Wasser SP, Weis AL. Medicinal properties of substances occurring in higher Basidiomycetes mushrooms: Current perspectives (Review). *Int J Med Mushrooms* 1999;1:31-62.
- Beattie KD, Rouf R, Gander L, May TW, Ratkowsky D, Donner CD, *et al.* Antibacterial metabolites from Australian macrofungi from the genus *Cortinarius*. *Phytochemistry* 2010;71:948-55.
- Ishikawa NK, Kasuya MC, Vanetti MC. Antibacterial activity of *Lentinula edodes* grown in liquid medium. *Braz J Microbiol* 2001;32:206-10.

20. Kawanabe J, Hirasawa M, Takeuchi T, Oda T, Ikeda T. Non-cariogenicity of erythritol as a substrate. *Caries Res* 1992;26:358-62.
21. Daglia M, Papetti A, Mascherpa D, Grisoli P, Giusto G, Lingström P, *et al.* Plant and fungal food components with potential activity on the development of microbial oral diseases. *J Biomed Biotechnol* 2011;2011:274578.
22. Lleo MM, Canepari P, Satta G. Bacterial cell shape regulation: Testing of additional predictions unique to the two-competing-sites model for peptidoglycan assembly and isolation of conditional rod-shaped mutants from some wild-type cocci. *J Bacteriol* 1990;172:3758-71.
23. Gazzani G, Daglia M, Papetti A. Food components with anticaries activity. *Curr Opin Biotechnol* 2011. DOI: 10.1016/j.copbio.2011.09.003.