

Anticariogenic activity of the crude ethanolic extract of *Potentilla erecta* (L.) Raeusch

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Summary

An ethanol extract of rhizomes of *Potentilla erecta* was investigated for its activity against the cariogenic bacterium *Streptococcus sobrinus/downei* CCUG 21020. The crude extract showed moderate antibacterial activity but strongly inhibited the total activity of streptococcal glucosyltransferases (GTFs) and their ability to synthesize water-insoluble glucan (mutan).

Key words: *Potentilla erecta*, anticariogenic activity, extract

INTRODUCTION

Glucosyltransferases produced by cariogenic streptococci such as *Streptococcus mutans* and *S. sobrinus* play a crucial role as one of the most important virulence factors of dental caries. Mutans streptococci produce at least three different GTFs: GTF B synthesizing mostly insoluble α -(1 \rightarrow 3)-linked glucan, GTF C synthesizing a mixture of insoluble and soluble α -(1 \rightarrow 6)-linked glucan, and GTF D synthesizing soluble glucan. Among them, GTFs B and C appear to be the most important GTFs related to dental caries [1]. The GTFs synthesize up to 30-40% (dry weight) of the polysaccharide fraction of the dental plaque matrix [2]. These glucans (especially

water-insoluble mutan) can enhance the pathogenic potential of dental plaque by promoting the accumulation of oral bacteria on human teeth. Therefore, one of the strategies to control plaque formation is to inhibit the activity of glucosyltransferases. These problems necessitate further search for natural anticariogenic agents which would be safe for humans and specific for oral pathogens.

Potentilla erecta is a medicinal plant collected in Poland from natural sites. It grows in forests, thickets, on meadows and glades, on moist and acid soils, appears as a common plant in whole country.

The extract of *P. erecta* is used in the pharmaceutical field, particularly in dermatology [3] and also in cosmetology, as an anti-seborrhea agent [4]. It is commonly used in European folk medicine as a remedy for diarrhea [5]. It has been shown that the tormentil root has antiinflammatory [6], immunostimulating [7], and potentially antiviral effects [8]. Water-soluble tormentil extract has antioxidant properties towards lipoperoxidation and anti-elastase activity [4]. To our best knowledge, there are no reports dealing with the use of the extract of rhizomes of *P. erecta* for dental caries prevention.

Dry *Potentilla* extract contains up to 40% of tannins such as polyphenols, saponin and other components [5]. Raw material contains phenolic acids (p-hydroxybenzoic, salicylic, β -resorcylic, gentisic, syringic, p-coumaric) and catechin [9]. Flowers of *Tormentilla potentilla* contain a number of polyene dyestuffs and two flavones and flavonols [10].

In this paper, we report the anticariogenic activity of the crude ethanolic extract of rhizomes of *Potentilla erecta*.

MATERIALS AND METHODS

Streptococcus sobrinus/downei CCUG 21020 (formerly *S. mutans* OMZ 176) was provided by the Culture Collection, University of Göteborg, Sweden.

Potentilla erecta (L.) Raeusch. (Rosaceae) rhizomes (*Rhizoma Tormentillae*) were obtained from a commercial source (Kawon-Hurt, Gostyń, Poland) and identified by Dr. M. Wawer, Department of Botany and Mycology, Maria Curie-Skłodowska University, Lublin, Poland. A voucher specimen is deposited in the Department of Industrial Microbiology, Maria Curie-Skłodowska University, Lublin, Poland.

Air-dried and powdered rhizomes of *P. erecta* were Soxhlet extracted with EtOH (45%), and the extract was concentrated to a solid residue (yield: 6.9%). Samples for the tests were dissolved in DMSO.

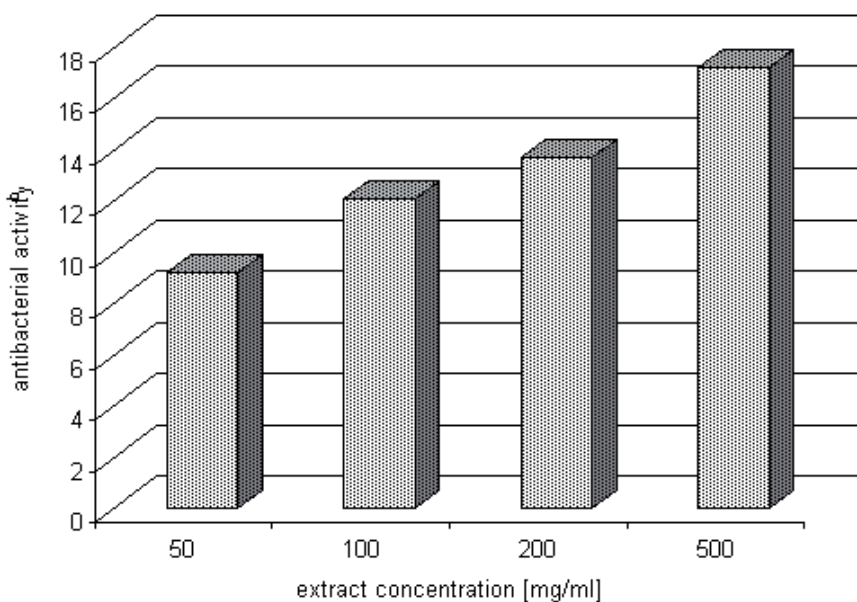
The glucosyltransferases used in all tests (inhibition of total GTFs activity and mutan formation) were produced by the cariogenic bacterium *S. sobrinus/downei* CCUG 21020 [11]. Antibacterial activity was determined by the disk diffusion method as described above [12].

The inhibitory effect of the *P. erecta* extract on total GTFs activity and mutan synthesis were examined. The GTFs activity assay was done using the protocol of

Mukasa et al. [13] by measuring the amount of fructose released from sucrose. Mutan formation was assessed by weight measurement according to previously described method [11].

RESULTS

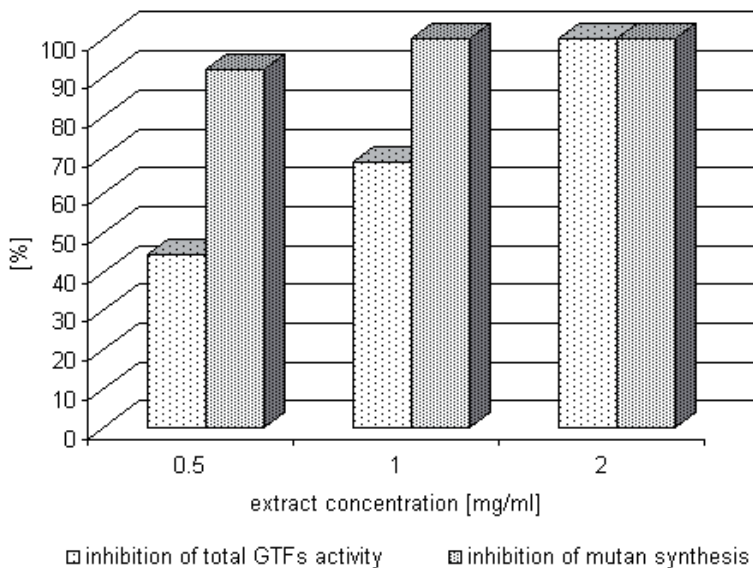
The presented results indicate that the extract from rhizomes of *P. erecta* possesses a mild antibacterial activity (fig. 1). Both total GTFs activity and mutan synthesis were strongly inhibited in the range of 0.5–2 mg extract/ml (fig. 2).



^aValues are the average of triplicate.

^bDiameter of inhibition zone (mm) including the filter paper disc diameter (6.0 mm). Gentamycin as a standard, inhibition zone diameter: 36.3 mm.

Figure 1. Antibacterial activity of the ethanol extract of *P. erecta* rhizomes against *S. sobrinus/downer*^a.



^aValues are the average of triplicate.

Figure 2. Effect of the ethanol extract of *P. erecta* rhizomes on the total activity of streptococcal glucosyltransferases and mutan synthesis^a.

CONCLUSIONS

The presented data show that *P. erecta* extract could become a useful supplement as a new anticariogenic agent in a wide range of oral care products such as toothpastes, mouthwashes and chewing gum.

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PRZECIWPŁÓCHNICZE DZIAŁANIE SUROWEGO EKSTRAKTU ETANOLOWEGO Z *POTENTILLA ERECTA* (L.) RAEUSCH.

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Streszczenie

Badano wpływ wyciągu etanolowego z kłączy *Potentilla erecta* na próchnicotwórczą bakterię *Streptococcus sobrinus/downei* CCUG 21020. Surowy ekstrakt etanolowy wykazywał umiarkowaną aktywność przeciwbakteryjną, natomiast silnie hamował całkowitą aktywność paciorkowcowych glukozylotransferaz (GTFs) oraz ich zdolność do syntezy nierezpuszczalnego w wodzie glukanu (mutanu).

Słowa kluczowe: *Potentilla erecta*, działanie przeciwpróchnicze, ekstrakt