

Antibacterial activity of Korean ginseng tea

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Summary

The aim of the study was an *in vitro* assessment of the antimicrobial efficacy of water, methanol and ethanol extracts of Korean ginseng tea, which is widely used in Asian folk medicine.

Nine test microorganisms were used: *Escherichia coli*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Staphylococcus epidermidis*, *Klebsiella pneumoniae*, *Proteus mirabilis*, *Bacillus subtilis*, *Bacillus cereus*, and *Salmonella enteritidis*. The minimum inhibitory concentration (MIC) of active extracts was determined by using a macro-broth-dilution assay. Methanol and ethanol extracts from the tea were active against some bacterial strains while only the water extract was active against all bacterial strains. The MIC values for active extracts ranged between 7.5 and 500 mg/ml. The results of the study indicate that ginseng may be safely used in the treatment of some infectious diseases.

Keywords: ginseng tea, antibacterial activity

The antimicrobial drugs have showed remarkably effectiveness for the control of bacterial diseases. However, it was real that bacterial pathogens were impossible to eradicate, because many pathogens rapidly become resistant to some of the first discovered antimicrobial drugs.

Today, the antimicrobial compounds from plants may inhibit bacterial growth than those currently used antimicrobial compounds and have a significant role in treatment of resistant microbial strains. Also the discovery of medicinal plants provide alternative health care including use of medicines derived from plants because they are easily available and economical than medicinal products.

Ginseng (*Panax ginseng*) is one of the most widely used medicinal plants worldwide (8, 9). All of *Panax* species are in the *Araliaceae* plant family, but *Panax ginseng* (Korean or Asian ginseng) might be the most mainly used (9). Recently, it was reported that ginseng roots has various effects (e.g. tonic, stimulant, agent to foster fatigue, stress-resistance, tranquilization, cerebro-protective, antioxidant, antiischemic) (4, 8, 9, 11). There is approximately 200 substances have been isolated from *Panax ginseng* including ginsenosides (ginseng saponins), polyacetylenes, alkaloids, polysaccharides, oligosaccharides, oligopeptides, flavonoids, lipids, vitamins and minerals (4, 9). The ginseng saponins, which are referred to with equal frequency as ginsenosides or panaxosides, are classified into three groups: the panaxadiol, the panaxatriol and the oleananesaponins (7). Researchers have reported antimicrobial activity of several phytochemical groups such as alkaloids, phenols, poly-

phenols, saponins, tannins, triterpenes, anthraquinones and steroids (12). The saponins, is considerable compounds in ginseng for most pharmacological actions (5). Also it was reported that the antimicrobial activity of plant materials was well correlated with the content of their flavonoid compounds (2, 6, 10). Korean ginseng tea prepared from the roots of *Panax ginseng*, is widely used by specially Korean people and other country people. Although it is become a world-famous medicinal plant (8) definitive data are not available concerning its antibacterial activity.

The present study was carried out investigate to antibacterial activity of Korean ginseng tea on against selected microorganisms.

Material and methods

Plant material. Korean ginseng tea was purchased from Korea. The studies were carried out using Korean ginseng tea which is an herbal preparation of roots of *Panax ginseng*, commonly marketed in Korea and China for oral use as infusion.

Bacterial cultures. *Klebsiella pneumoniae* (ATCC 4352), *Proteus mirabilis* (CCM 1944), *Bacillus subtilis* (ATCC 6633), *B. cereus* (ATCC 11778), *Pseudomonas aeruginosa* (ATCC 27853), *Escherichia coli* (ATCC 25922), *Staphylococcus epidermidis* (ATCC 12228), *S. aureus* (ATCC 29213) and *Salmonella enteritidis* (KUEN 349) were used for the detection of antibacterial effect of the extracts.

Extracts preparation. The tea extracted with different solvent (methanol, ethanol and boiling water) for comparative analysis. 0.3 g of tea sample was mixed with 30 ml of each solvent. The mixtures were left overnight by maceration for 24 h at room temperature and then filtered Whatman No.1 filter. The methanol and ethanol extracts were concentrated

to dryness under reduced pressure at 35°C, using a rotary evaporator. The water extracts was concentrated by a stream of nitrogen at room temperature. The final solid material stored at -80°C. All extracts were dissolved in dimethyl sulfoxide (DMSO) to a final concentration 100 mg/ml.

Antibacterial activity of the compounds. Minimum inhibitory concentration of the extracts was determined by the macrobroth dilution technique according to the Committee for Clinical Laboratory Standards (NCCLS) (1). Mueller-Hinton broth (pH 7.3) with Mg⁺⁺ (10 mg/ml) and Ca⁺⁺ (10 mg/ml) was used as the medium. Serial two fold dilutions of the extracts were prepared in the media. The bacterial suspensions (3-7 × 10⁵ cfu/ml) were added into the all tubes and the control tube which did not contain any compound. The tubes were incubated at 37°C for 16-20 hours. The MIC was defined as the lowest concentration of a extract giving complete inhibition of visible growth.

Results and discussion

Out of the three extracts (methanol, ethanol, boiling water) tested, showed different activity against *Klebsiella pneumonia* (ATCC 4352), *Proteus mirabilis* (CCM 1944), *Bacillus subtilis* (ATCC 6633), *B. cereus* (ATCC 11778), *Pseudomonas aeruginosa* (ATCC 27853), *Escherichia coli* (ATCC 25922), *Staphylococcus epidermidis* (ATCC 12228), *S. aureus* (ATCC 29213) and *Salmonella enteritidis* (KUEN 349). Alcohol maceration is the popular method for preparing root-based traditional herbal remedies, so we preferred methanol and ethanol extraction additionally boiling water extraction.

The MIC values of the extracts against the microorganisms are given in table 1.

The resistance to antimicrobials has increased, especially the last decade in our country and in the world. The antimicrobial compounds use from plants may have a significant clinical value in treatment of resistant microbial strains. *Panax ginseng* is one of the most generally used all the world, also traditionally for increase mental and physical performance, impotence and prevention of hepatotoxicity (4, 8). Some researchers have attributed antibacterial activity to the presence flavonoid and saponins which are well known (2, 6, 10, 12). *Panax ginseng* contains ginsenosides and other phytochemical substances such as alkaloids, flavonoids, lipids, vitamins. The ginsenosides are triterpene saponins and considered to be the major active compounds of *Panax ginseng*. These phytochemical compounds in this study, have been associated with the antibacterial activity of Korean ginseng tea. It was reported that the methanol solvent is known with its ability isolate more antimicrobials from plants including tannins, polyphenols, terpenoids, saponins, flavones, xanthoxylines, quassinoids, lactones, totarol, phenones, while the water solvent extracts could contain only anthoyanins, starches, tannins, saponins, terpenoids, polypeptides, and lectins (3). Also alcohol maceration is the popular method for preparing root-based traditional herbal remedies. But our results showed that the antibacterial activity of Korean ginseng tea by the water extract a wider spectrum than the methanol and ethanol extracts.

Although very few studies have been reported on *Panax ginseng*, compounds such as flavonoids and sapo-

Tab. 1. Minimum inhibitory concentrations of methanolic, ethanolic, water extracts of Korean ginseng tea against test bacterial strains determined by macro-broth dilution methods

Test bacterial strain	Macro-broth dilution MIC (mg/ml)		
	Methanol extract	Ethanol extract	Water extract
<i>Pseudomonas aeruginosa</i> (ATCC 27853)	37.5	250	7.5
<i>Salmonella enteritidis</i> (KUEN 349)	ND	500	7.5
<i>Escherichia coli</i> (ATCC 25922)	37.5	250	7.5
<i>Proteus mirabilis</i> (CCM 1944)	ND	500	7.5
<i>Bacillus cereus</i> (ATCC 11778)	37.5	250	7.5
<i>Staphylococcus epidermidis</i> (ATCC 12228)	ND	500	15
<i>Staphylococcus aureus</i> (ATCC 29213)	ND	ND	15
<i>Klebsiella pneumonia</i> (ATCC 4352)	75	500	7.5
<i>Bacillus subtilis</i> (ATCC 6633)	ND	500	7.5

Explanation: ND – not determined as the minimal inhibitory concentration (MIC)

nins were shown to antimicrobial activity. From these assertions in this study, our results showed that a possible antibacterial effect of Korean ginseng tea (herbal product from the roots of *Panax ginseng*), but should be eventually confirmed with in vivo studies.

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