Antimicrobial Activity of Crude Extracts of Turnip (*Brassica rapa*)

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Turnips are among the most commonly grown and widely adapted root crops. Turnip roots are used raw or cooked as a vegetable and tops are used as potherb like spinach. Turnip roots are also grown for feeding livestock during fall and winter. In folk medicine, the powdered seed is said to be a remedy for cancer and breast tumors, while a salve derived from the roots can help to treat skin cancer. In this research, the antimicrobial activity of methanol, ethanol, n-hexane and chloroform extracts of turnip was evaluated with bacteria and mold. Alcoholic extracts of turnip were prepared and their antimicrobial activity was tested using an agar diffusion method. The highest antimicrobial activity was obsereved by methanolic extracts on *Micrococcus spp* while mold was resistant to this extract. Other alcoholic extracts also showed higher activity on *Micrococcus spp*.

Key words: *Micrococcus spp*, turnip, plant extract, *Brassica rapa*.

Native to western Asia, the turnip has served as food for humans and their livestock for centuries. The turnip was a daily staple in Europe before potatoes were. Turnips (Fig. 1) are among the most commonly grown and widely adapted root crops. Turnip roots are used raw or cooked as a vegetable and tops are used as potherb like spinach. Turnip roots are also grown for feeding livestock during fall and winter. In folk medicine, the powdered seed is said to be a remedy for cancer and breast tumors, while a salve derived from the flower is said to help skin cancer[1].

The use of plant compounds for pharmaceutical purposes is gradually increasing[2]. The antibacterial activity of turnip roots has long been purposed in folk medicine and in traditionally cure for common cold. Turnip, also known as *Brassica rapa* and sub sp. *rapa* is cultivated for its tuberous taproots, sometimes is considered as a weed[3]. Different diversities from the China-Japan, Eurosiberia and Mediterranean centers have been reported to tolerate aluminum, bacteria, disease, frost, fungi, extreme pHs, smog, sulfur dioxide virus and weeds[3]. Bioassays directed fractionation of the most active crude extracts of different plants have isolated and identified the compounds responsible for the antimicrobial activity[4]. These compounds are known by their active substances, for example, the phenolic compounds which are part of essential oils, as well as in tannins[2]. It has been shown that some antifungal proteins present in different Brassicaceae species

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can specifically inhibit fungal growth[5]. Among these antifungal proteins, one protein has shown decreased antifungal and increased antibacterial activity.

Several research works have revealed that amending the soil with plant of *Brassica* spp. can reduce the disease incidence or inoculum level of *Macrophomina phaseolina* (Tassi) Goid., *Pythium ultimum* Trow, *Fusarium oxysporum* Schl. F. sp. *cumini* Patel[6,7]. The mechanism involved in the disease control or suppression of a pathogen is considered to be the production of allyl isothiocyanate (AITC) by the tissues of *Brassica* spp[8]. AITC can show its antimicrobial activity on fungal propagules by vapor action, thus acting as a fumigant[9-11]. This volatile compound is produced in an aqueous medium through enzymatic hydrolysis of sinigrin, which is the predominant glucosinolate in the tissue of *Bassica* spp. Among the *Bassica* spp. The highest concentrations of AITC are found in some mustard (*Bassica juncea* L.), horseradish [*Armoraracia* (Mey). & Scherb] and wasabi (*Wasabia japonica* Matsum) species, with considerable variation among the cultivars of the same species[8].

The purpose of the present work was, therefore, to examine the antibacterial effect of crude extracts of turnip species grown in northern Iran on different bacteria.

MATERIAL AND METHODS

Materials

Microorganisms and bacterial samples (Table 1) were taken from collection of microbiology laboratory in Guilan University. Fungi samples were also taken from collection of medical parasitology in Guilan University of Medical Sciences. Phytochemical solvents, methanol and ethanol were of reagent grade and used as supplied by company.

Culture media, nutrient agar, nutrient browth and dextrose agar were purchased supplied by Merck.

Turnips (*Brassica rapa*) were harvested in Guilan Province in the North of Iran in Jaunary 2006 and identified by Departments of Agriculture and Biology of The University of Guilan in Rasht.

Methods

Preparation of turnip extracts

Different parts of turnips were dried and grounded into fine powder, added to each

Table 1. Antibacterial and antifungal activity of turnip (*Brassica rapa*) extracts[a]

Microorganism	Zone of inhibition (mm)[b]				Antimicrobial activity
	M_T	M_C	E_T	E_C	
Gram-positive					
Bacillus subtilis	22	17	19	15	+
Staphylococcus aureus	27	20	20	19	+
Micrococcus	30	22	28	21	+
Bacillus (without spore)	25	20	21	19	+
Gram-negative					
Serratia	20		16		+
Escherichia coli	22		21		+
Klebsiella pneumonia	23		20		+
Samonella	25		20		+
Shigella	29		26		+
Fungi	-	-	-	-	-
Aspergillus	-	-	-	-	-
Filamental fungus					
Yeast	-	-	18	16	+

[a] M - methanol, E - ethanol, $_T$ Tuber of turnips, $_C$ Cortex of tuberous taproot in turnip
[b] Data are the average of three experiments.

extracting solvent, mixed and left for 48 hours. The resulting solutions were filtered and the solvents were evaporated. The methanolic and ethanolic extracts were then used for antimicrobial activity tests.

Antimicrobial activity

A modified procedure of disk diffusion method[2, 12] was used to study the antimicrobial activity of turnip extracts. The bacterial cultures were grown on nutrient agar at 35°C. After 18 hours of growth, the colonies of each microorganism were then added to 8 ml of broth culture medium. The culture media were incubated at 35°C for another 18 hours. 0.1 ml of each medium was added to new nutrient broth culture media at 35°C. The cultures were incubated for 2-3 hours at 35°C and then placed on the surface of nutrient agar plates (spread plate culture method) at a concentration of 10^6 cells/ml. Subsequently, blank paper disks (6 mm in diameter) saturated with 400 ml of each solvent (phytochemical solution) was placed on surface of each plate. The plates were then incubated at 37°C (or 35°C) for 18-24 hours. The inhibition zones were visible after this period. In the case of mold and yeast, Sabroud Dextrose Agar (S.D.A) culture medium at 25°C was used. 1 ml of physiology serum was added to 9.0 ml of nutrient broth (1:10) and after growth of yeast (or mold), it was incubated on the surface of S.D.A. The saturated paper disks with ethanolic or methanolic extracts were later placed on the surface of each plate and incubated at 25°C.

The procedures mentioned above were exactly repeated after 8 months of storage the crude extracts at 4^0C in order to examine the stability of active chemical compounds present in the alcoholic extracts.

Roots

Flowers

Fig. 1. Turnip (*Brassico rapa*)

RESULTS AND DISCUSSIONS

According to the results obtained from this study, the alcoholic extracts of turnip showed antimicrobial activity for most of the bacterial samples used. Data in Table I show that the highest antimicrobial activity is exhibited by methanolic extracts of turnip tuber against *Micrococcus* and *Shigella*. It must be added that only in rare cases negative antimicrobial activity was observed, these results were omitted from the data. On the other hand, none of the tested extracts showed antifungal activity. In the case of yeast, the methanolic extracts were not active, while some activity was exhibited by ethanolic extracts. In fact, a zone of inhibition was observed in the case of methanolic extracts of both turnip tuber and cortex against yeasts during 48 hours, but it was vanished later. The presence of inhibition zone and its disappearance occurred in the case of methanolic and ethanolic extract against fungus too.

The results of activity measurement for the 8 months old extracts were exactly similar and, therefore, are not presented in the table.

CONCLUSION

Alcoholic extracts of different parts of turnips have potent antimicrobial activity against both Gram positive and Gram negative bacteria. This characteristic of turnips has received attention in folk medicine and turnips are used for treatment and pre-cautions of bacterial infection especially in winter and fall. Appearance of inhibition zones of methanolic and ethanolic extracts of various parts of the plant against fungi and yeast suggests that the active compounds present in the crude extracts may have been chemically changed under the conditions of incubation. This was observed more significant in the case of ethanolic extracts showing that the compounds are more stable in methanol than they are in ethanol. The evidence for this observation was confirmed when the crude extracts was examined after 8 months storage and the same results obtained in all cases.

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