

Protective effects of Taraxaci Herba extract against γ -irradiation

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1. Introduction

The expanding usage of radiation and radioisotopes in industry, medicine, and scientific research operations has entailed the necessity of efficient radioprotectors to reduce the biological damage during medical usage or after accidental exposure. Natural products such as herbal medicines, which are relatively less toxic, have recently begun to receive some attention as possible modifiers for radiation response.

Taraxaci Herba (the aerial part of *Taraxacum mongolicum*, Compositae family) is a medicinal herb which has been traditionally used in Eastern Asia. In this study, we have evaluated the antioxidant and radioprotective activity of hot water extract of Taraxaci Herba (TH extract) in vitro and in vivo models.

2. Methods and Results

The aerial part of *Taraxacum mongolicum* H. Mazzetti was decocted with boiling water for 3 hours. The extract was filtered, lyophilized and dissolved in distilled water before use. To assess the radioprotective effects of Taraxaci Herba extract (TH extract), we examined its effects on radical scavenging, radiation-induced DNA and chromosome damage, hematopoietic stem cell survival, and 30-day survival.

2.1 Radical scavenging activity

To assess the antioxidative activity of TH extract, we investigated DPPH (1,1-diphenyl-2-picryl hydrazyl) radical scavenging activity [1], and superoxide anion scavenging activity in TPA-treated differentiated HL-60 cells. TH extract showed dose-dependent scavenging activity against DPPH radical and superoxide anion, indicating that it has antioxidative capacity (Figure 1).

2.2 Reduction of radiation-induced DNA damage

Radiation produces DNA damages, which is one of the main causes of cellular damage. The effects of TH extract on oxidative DNA damage induced by γ -irradiation (2Gy) was examined by single cell gel electrophoresis (comet assay) [2]. The level of DNA damage (tail moment) in lymphocytes was greatly increased by γ -irradiation. The increase of DNA

damage was significantly attenuated by 20-500 μ g/ml TH extract (Figure 2).

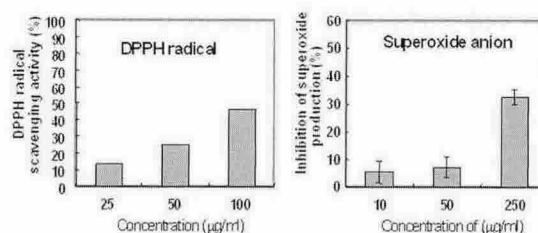


Figure 1. Radical scavenging activity of TH extract against DPPH radical and superoxide anion.

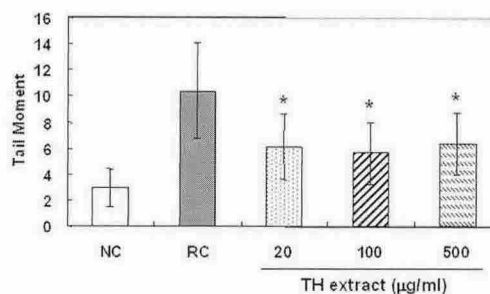


Figure 2. Reduction of radiation-induced DNA damage by TH extract. Mouse lymphocytes were incubated in the presence of TH extract for 4 hours and irradiated with γ -ray (2Gy). DNA damage was measured by single cell gel electrophoresis and expressed as Tail Moment. * p <0.01 as compared with the irradiation control group

2.3 Inhibition of radiation-induced micronuclei formation

To see the inhibitory effects of TH extract against DNA damage in chromosomal level, the micronuclei formation assay was performed with HL-60 cells (Table 1). HL-60 cells irradiated with γ -ray exhibited higher rate of micronuclei formation compared with normal control. However, the treatment of TH extract reduced the radiation-induced micronuclei formation by about 40%.

Table 1. Effects of TH extract on radiation-induced micronuclei formation in HL-60 cells.

Sample	Micronuclei (MN) distribution per 1000 binucleate cells \pm SD			
	1 MN	2 MN	3 MN	Total MN
Normal control	16 \pm 2.8	2 \pm 0.7	0	19 \pm 4.2
Irradiation control (2Gy)	251 \pm 7.8	41 \pm 4.9	10 \pm 2.1	363 \pm 27.0
TH extract (100 μ g/ml)	176 \pm 7.8	25 \pm 0.7	2 \pm 0.7	229 \pm 7.1*

*Significantly different from irradiation control group ($p < 0.01$)

2.3 Increase of endogenous spleen colony formation

To examine the effect of TH extract on hematopoietic stem cell survival in irradiated mice, endogenous spleen colony formation was examined [3]. The administration of TH extract at doses of 300 and 600 mg/kg BW increased spleen colonies by 4.3 fold and 9.8 fold, respectively (Figure 3). This indicates that the administration of TH extract increases the survival of hematopoietic stem cells in irradiated mice.

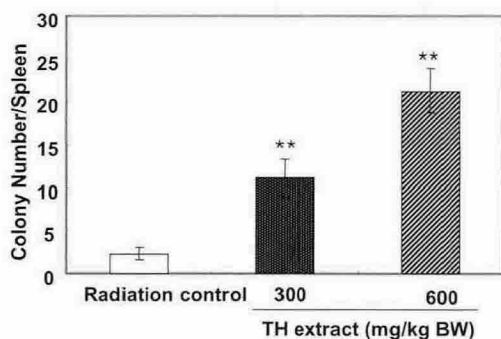


Figure 3. Effects of TH extract on endogenous spleen colony formation in irradiated mice. Mice were orally administered (300 or 600 mg/kg BW/day) twice before and 5 times after irradiation (7Gy). Each group contained 10 mice.

2.5 Enhanced survival rate of irradiated mice

To evaluate the comprehensive radioprotective effect of TH extract, the survival of mice that received the γ -irradiation (8Gy) were examined (Figure 4). In the group exposed to irradiation only, 50% of the mice survived at day 30 after irradiation. However, 90% of the mice survived when administered with TH extract before and after irradiation.

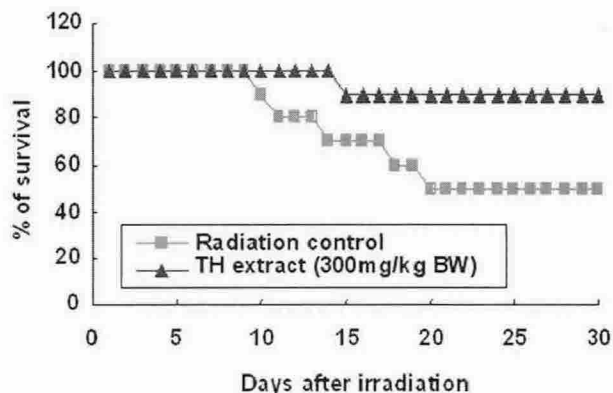


Figure 4. Effects of TH extract on the survival rate of γ -irradiated mice. ICR mice were orally administered with TH extract at a dose of 300 mg/kg BW/day twice before and 5 times after irradiation (8Gy). Each group consisted of 10 mice.

3. Conclusion

In this study, it was demonstrated that the Taraxaci Herba extract (TH extract) has antioxidative and radioprotective activity. TH extract showed radical scavenging activity, reduced radiation-induced DNA damage, protected the hematopoietic stem cells from irradiation, and enhanced the survival rate of irradiated mice. Taraxaci Herba has long been used in folk medicine and is relatively non-toxic. These results collectively suggest that TH extract might be a good radioprotective agent.

REFERENCES

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