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Short communication

Determination of antioxidant activity of different drug delivery systems loaded with BER on the liver

Ayca Gungor Ak[1], Aysegul Karatas[2]*

[1]*Republic of Turkey Ministry of Health, Turkish Medicines and Medical Devices Agency, 06100, Ankara, Turkey*
[2]*Ankara University Faculty of Pharmacy, Department of Pharmaceutical Technology, 06560, Ankara, Turkey*

Introduction

Berberine (BER) is a quaternary benzylisoquinoline alkaloid that can be obtained from many different plants. In recent years many therapeutics effects of BER have been studied by various researchers. The antioxidant activity of BER has been demonstrated by studies (Hasanein et al., 2017). Chen et al., in their study on sea bass, showed that BER significantly reduced the level of malondialdehyde (MDA), a lipid peroxidation product (Chen et al., 2022). There has been a need to develop a drug delivery system to increase the oral bioavailability of BER. In this study drug delivery systems developed to increase oral bioavailability are berberine phospholipid complex (BER-P), berberine nanoparticles (BER-NPs) and chitosan nanoparticles loaded with berberine phospholipid complex (BER-PNPs). Antioxidant activities of these drug delivery systems on the liver were determined in comparison with berberine.

Materials and methods

Reverse phase evaporation method was used for the preparation of BER-P. For the preparation of BER-P, BER and phospholipid (1:2 ratio) were reacted at 60° for 1 hour. BER-NPs were prepared by ionotropic gelation method (Ak et al., 2023). BER-PNPs were prepared by ionotropic gelation method. The prepared BER-P was loaded into nanoparticles. For all formulations, the amount equaled to 50 mg/kg dose was calculated according to the weight of the rat to be administered and administered by oral gavage. After 24 hours liver tissues were quickly removed on ice. Liver tissue oxidant and antioxidant status was evaluated by measuring lipid peroxidation and reduced glutathione. MDA level as an indicator of lipid peroxidation determined by the method of Casini et al (Casini et al., 1986). Tissue samples for MDA determination were homogenized by adding cold 10% trichloroacetic acid to 9 ml per gram of tissue. The absorbance of the samples at 535 nm was measured spectrophotometrically.
Glutathione (GSH) levels, which is the major endogenous antioxidant, were studied according to the method of Aykac et al. (Aykac et al., 1985).

Results and discussion

Using various equations the calculated MDA and GSH levels are given in Table 1.

Table 1. The effect of BER on oxidative stress (n=8, mean ± SD)

Groups	MDA levels (nmol/g)	GSH levels (μmol/g)
Control	105.9 ± 30.6	32.8 ± 4.60
BER	93.0 ± 23.1	49.8 ± 5.85*
BER-P	88.8 ± 12.9	53.0 ± 5.08*
BER-NPs	92.1 ± 16.5	53.4 ± 2.60*
BER-PNPs	75.9 ± 8.25*	54.5 ± 1.83*

**p<0.05*, Values that differ significantly from the control group values

According to the results obtained in our study, when the antioxidant activities of BER and formulations on liver tissues were evaluated comparatively, it was seen that BER group and formulation groups decreased MDA levels compared to the control group.

*akaratas@pharmacy.ankara.edu.tr

In the statistical evaluation, it was observed that only the BER-PNPs group had a significant decrease in MDA level compared to the control group. GSH levels were significantly increased in all treatment groups compared to the control group ($p<0.05$).

Conclusion

The effects of BER and formulations on oxidative stress were investigated on liver tissues taken from rats in in vivo animal experiments. MDA is the end product of lipid peroxidation and is used as a marker. GSH is one of the most important endogenous antioxidant enzymes and is considered an indicator of antioxidant activity.

According to the results obtained in the study, it was seen that the BER and formulations showed antioxidant activity on the liver. When evaluated in terms of both values, BER-PNPs were found to be more effective in terms of antioxidant activity. With this study, both the antioxidant activity of berberine on the liver has been proven, and an effective drug delivery system has emerged as a promising system.

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