

Letter to the Editor

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## Silymarin as a Promising Potential Therapeutic Agent for Treatment of Patients with Paraquat Poisoning: An Issue that Merits Further Research

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Having an extremely toxic compound for humans and most animals, paraquat (PQ) is known as one of the most frequently used herbicides. Accordingly, PQ poisoning has been recognized as a serious medical problem across the world, with a severe case fatality rate (CFR) (1, 2). In this respect; accidental or intentional ingestion of PQ, even in a small amount, can be significantly associated with poor clinical prognosis and increased mortality. Moreover; inherent toxicity of PQ, absence of specific antidotes, as well as lack of effective treatments have been principally attributed to high fatality of PQ poisoning. Once PQ is ingested, it can be absorbed through skin and the digestive and respiratory system and often progresses to multi-organ failure, particularly the lungs as the main target. In this respect, PQ accumulates predominantly in the lungs and can lead to lung fibrosis, pneumonitis, and consequently respiratory failure and death (2, 3). Given the nonexistence of specific and widely accepted guidelines for treatment of PQ poisoning, a range of conservative therapeutic modalities have been proposed and administered by clinicians to moderate PQ absorption and to prevent organ failure in these patients. In spite of this, PQ-induced mortality rate is high and disappointing (1, 3).

Although the exact mechanism of PQ-induced toxicity has not been fully elucidated, inflammation and oxidative stress have been proposed as the most widely accepted ones. Therefore, it is reasonable to assume that use of antioxidants may reduce and protect against PQ-induced toxicity (2, 3). Recently, Silymarin has been evaluated and advocated as a potential promising treatment modality for PQ poisoning. As a polyphenolic flavonoid, Silymarin is extracted from seeds and fruits of milk thistle (also known as *Silybum marianum*). It has been previously confirmed that Silymarin has anti-inflammatory and antioxidant activity, without any significant adverse effects (4, 5). In an in-vitro study by Liu et al., Silymarin had

significantly reduced PQ-induced macrophage cytotoxicity through suppressing inflammatory and oxidative responses (1). Moreover, in another in-vitro study; Podder et al. had confirmed the protective effect of Silymarin against PQ-induced cytotoxicity on human lung adenocarcinoma cell line (4). To add this, Zaho et al. in an in-vivo and in-vitro study had demonstrated the significant protective effect of Silymarin against PQ-induced lung injury via reducing oxidative stress and inflammatory response (2). Furthermore, in a study on rats, the protective effect of Silymarin against PQ-induced hepatotoxicity had been validated (3).

In sum; considering the high mortality rate of PQ poisoning and lack of adequate and efficacious standard treatments for this condition as well as the crucial role of inflammation and oxidative stress in pathogenesis of PQ-induced toxicity and given the potential anti-inflammatory and anti-oxidative properties of Silymarin in reducing PQ-induced toxicity, it seems that Silymarin can be employed as a safe and effective therapeutic modality for patients with PQ poisoning. However, further well-designed clinical trials are needed to evaluate the efficacy and the optimal dose of Silymarin in treatment of patients with PQ poisoning.

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### AUTHOR CONTRIBUTION

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### CONFLICT OF INTEREST

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