Saudi Journal of Biological Sciences (2016) xxx, xxx–xxx

King Saud University

Saudi Journal of Biological Sciences

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ORIGINAL ARTICLE

Protective effect of some plant oils on diazinon induced hepatorenal toxicity in male rats

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Received 11 August 2016; revised 7 October 2016; accepted 9 October 2016

KEYWORDS

Diazinon;
Plant oils;
Blood;
Liver;
Kidney;
Rats

Abstract Environmental pollution and exposure to environmental pollutants are still some of the major global health issues. Pesticides have been linked to a wide range of health hazards. The toxicity of pesticides depends on several factors such as its chemical properties, doses, exposure period, exposure methods, gender, genetics, age, nutritional status and physiological case of exposed individuals. Medicinal plants, natural products and nutrition continue to play a central role in the healthcare system of large proportions of the world's population. Alternative medicine plays an important role in health services around the world. The aim of this study was to investigate the effect of olive, sesame and black seed oils on hepatorenal toxicity induced by diazinon (DZN) in male rats. The experimental animals were divided into nine groups. The first group served as control. The second group was exposed to DZN. The third group was treated with olive oil and DZN. Rats of the fourth group were subjected to sesame oil and DZN. Rats of the fifth group were exposed to black seed oil and DZN. The sixth, seventh and eighth groups were supplemented with olive, sesame and black seed oils respectively. Rats of the ninth group were treated with corn oil. Levels of serum alanine aminotransferase, aspartate aminotransferase, alkaline phosphatase, gamma glutamyl transferase, total bilirubin, creatinine, blood urea nitrogen and malondialdehyde were significantly increased in rats exposed to DZN. Moreover, levels of serum glutathione and superoxide dismutase were significantly decreased. Several histopathological changes were observed in the structures of liver and kidney due to DZN exposure. This study showed that these oils attenuated the physiological disturbances and histopathological alterations induced by DZN intoxication. Moreover, the antioxidant properties of these oils support the bioactive roles of its protective effects on DZN toxicity. This study therefore suggests that these oils could be used as preventive factors against the toxicity of DZN due to its antioxidant properties.

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Peer review under responsibility of King Saud University.

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1. Introduction

Environmental pollution is tangled with unsustainable anthropogenic activities, resulting in substantial public health problems. The significance of environmental factors to the health and well-being of human populations' is increasingly apparent

http://dx.doi.org/10.1016/j.sjbs.2016.10.013
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Please cite this article in press as: Al-Attar, A.M. et al., Protective effect of some plant oils on diazinon induced hepatorenal toxicity in male rats. Saudi Journal of Biological Sciences (2016), http://dx.doi.org/10.1016/j.sjbs.2016.10.013

(Rosenstock, 2003; WHO, 2010). The occurrence of harmful chemicals in the environment has become an issue of great debate in recent decades (Bao et al., 2015). Environmental pollution caused by pesticide residues is a major concern due to their extensive use in agriculture and in public health programs (Waliszevski et al., 1996). Organophosphorus compounds are one of the most common types of organic pollutants found in the environment (Tang et al., 2009). Toxicities of organophosphorous insecticides cause adverse effects on many organs (Gupta, 2006). Systems that could be affected by organophosphorous insecticides are the nervous system, immune system, liver, muscles, urinary system, reproductive system and hematological system (Benjamin et al., 2006; Al-Attar, 2009, 2010, 2015; Al-Attar and Al-Taisan, 2010; Al-Attar and Abu Zeid, 2013; Holy et al., 2015; Tian et al., 2015; Abdel-Daim, 2016; Judge et al., 2016; Li et al., 2016; Mehri et al., 2016). Diazinon (DZN), $C_{12}H_{21}N_2O_3PS$, is an organophosphorous insecticide which is widely and effectively used throughout the world with applications in agriculture and horticulture for controlling insects in crops, ornamentals, lawns, fruit, vegetables and other food products (Grafitt et al., 2002; Tang et al., 2009; Sarabia et al., 2009). The main mechanism of action of DZN is acetyl-cholinesterase enzyme inhibition (Kamanyire and Karalliedde, 2004). Moreover, several investigations have showed that DZN was capable of inducing histopathological, biochemical and physiological alterations (Al-Attar, 2009, 2015; Al-Attar and Al-Taisan, 2010; Al-Attar and Abu Zeid, 2013; Abdel-Daim, 2016).

In recent years, interest has increased in using natural products for pharmacological purposes, as a form of complementary or replacement therapy. Herbal medicine is increasingly gaining acceptance from the public and medical professionals due to advances in the understanding of the mechanisms by which herbs positively influence health and quality of life (Panda and Naik, 2009). The use of herbal medicines and phytonutrients or nutraceuticals continues to expand rapidly across the world with many people now resorting to these products for treatment of various health challenges in different national healthcare settings (WHO, 2004).

The olive tree (*Olea europaea* L.), family: Oleaceae, has been widely accepted as one of the species with the highest antioxidant activity via its oil, fruits, and leaves. It is well known that the activity of the olive tree by product extracts in medicine and food industry is due to the presence of some important antioxidant and phenolic components to prevent oxidative degradations. There is growing evidence that olive oil may have great health benefits including the reduction in coronary heart disease risk, the prevention of some cancers and the modification of immune and inflammatory responses (Keys, 1995; Stark and Mader, 2002; Visioli and Galli, 2002). Sesame (*Sesamum indicum*) is one year old seed and belongs to the Pedaliaceae family (Zavareh et al., 2008). Sesame is one of the richest dietary sources of lignan, phytoestrogiens which exist in it were known to humans from the beginning of civilization and they are mixed with human food because of having many benefits for health (Thompson et al., 1991). Moreover, the seeds of sesame are used as a demulcent in respiratory affections, infantile cholera, diarrhea, dysentery and other bowel infections and bladder diseases. The seed powder is useful in amenorrhea, dysmenorrhea, ulcers and bleeding piles. Unsaponifiable matter (sterols), fibers as well as lignan-type compounds such as sesamin, sesamolin, sesamol and sesaminol are recognized to be potent therapeutic agents (Namiki, 2007). *Nigella sativa* (commonly known as black seed and black cumin), is a dicotyledon of Ranunculaceae family. The oil and seed constituents have shown potential medicinal properties in traditional medicine (Salem, 2005). The seeds of *N. sativa* have long been used in the middle and far east as a traditional medicine for a wide range of illnesses including bronchial asthma, headache, dysentery, infections, obesity, back pain, hypertension and gastrointestinal problems (Schleicher and Saleh, 1998; Al-Rowais, 2002). Thymoquinone is the most potent and pharmacologically active constituent in the volatile oil of seeds of *N. sativa*. It has been reported to have various therapeutic effects such as antiinflammatory, antibacterial, antifungal, antiparasitic, antiasthmatic, antidiabetic, anticancer and antioxidant (Houghton et al., 1995; Worthen et al., 1998; Galaly et al., 2014; Saravanan et al., 2014; El-Sheikh et al., 2015; Erboga et al., 2016). The present study is aimed to investigate the effect of olive, sesame and black seed oils on hepatorenal injury induced by DZN intoxication in male rats.

2. Materials and methods

2.1. Animals model

Male albino rats of the Wistar strain (*Rattus norvegicus*), weighing 92.8–133.3 g were utilized in the present study. The experimental animals were obtained from the Experimental Animal Unit of King Fahd Medical Research Center, King Abdulaziz University, Jeddah, Saudi Arabia. Rats were acclimatized to the laboratory conditions for one week prior to the initiation of experimental treatments. The experimental animals were housed in standard plastic cages and maintained under controlled laboratory conditions of humidity (65%), temperature (20 ± 1 °C) and 12:12 h light: dark cycle. Rats were fed *ad libitum* on normal commercial chow and had free access to water. The experimental treatments were conducted in accordance with ethical guidelines of the Animal Care and Use Committee of King Abdulaziz University.

2.2. Experimental design

A total of ninety rats were randomly divided into nine experimental groups, ten of rats each. The experimental groups were treated as follows:

1. Rats of group 1 were untreated and served as controls.
2. Rats of group 2 were orally administrated with 50 mg/kg body weight of DZN in corn oil, daily for 6 weeks.
3. Rats of group 3 were orally supplemented with olive oil at a dose of 600 mg/kg body weight and after 4 h exposed to DZN at the same dose given to group 2, daily for 6 weeks.
4. Rats of group 4 were orally supplemented with sesame oil at a dose of 600 mg/kg body weight and after 4 h subjected to DZN at the same dose given to group 2, daily for 6 weeks.
5. Rats of group 5 were orally supplemented with black seed oil at a dose of 600 mg/kg body weight and after 4 h treated with DZN at the same dose given to group 2, daily for 6 weeks.

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