Antioxidant effect of parsley and *panax ginseng* extract standardized with ginsenosides Rg3 against alteration induced in reproductive functions in male mice

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**Abstract**

In the present study, the antioxidant effects of parsley oil and *panax ginseng* have been evaluated against the clastogenicity of ZEN. One hundred and eight mature male mice were distributed into nine treatment groups, including the control group and the groups treated with parsley oil (0.6 ml/kg b.w), *panax ginseng* extract (40 mg/kg b.w) or parsley oil plus *panax ginseng* extract with or without ZEN (10 µg/kg b.w). Animals within different treatment groups were divided into two subgroups (A and B). Subgroup A were used for the determination of serum testosterone levels and chromosomal aberrations and received their respective doses for two weeks whereas, subgroup B were used for sperm abnormality and received their respective doses twice a day for one week and sacrificed after 30 days. The results indicated that ZEN treatment resulted in a significant decrease in testosterone concentration, sperm count and sperm motility. Whereas it caused a significant increase in abnormal sperms counts and total chromosomal aberrations in germ cells. Animals treated with parsley oil or *panax ginseng* extract alone or in combination were comparable to the controls regarding all the tested parameters. The combined treatment with ZEN and parsley oil, *panax ginseng* or parsley oil plus *panax ginseng* extract resulted in a significant improvement in all tested parameters. Moreover, parsley oil was found to be effective than *panax ginseng* extract and the combined treatment was more effective than the single treatment. It could be concluded that both parsley oil and *panax ginseng* extract induced a protective action against ZEN-induced alteration in the reproductive performance and the combined treatment may be useful than the single treatment.

**Key words:** Zearalenone, parsley oil, *panax ginseng*, cytogenetic, germ cells, testis, testosterone and chromosomal aberration.

**Introduction**

Herbal remedies are used world wide to alleviate symptoms, to treat illnesses, and to promote overall wellness. An estimated 60% of the world's population and 40% of Americans use herbal remedies (Astin, 1998). However, use of medicinal herbs may be unsupervised and unproved efficacy (Boniel and Dannon, 2001; Ernst and Cassileth, 1999).

Parsley (*Petroselinum crispum*) is an important culinary herb native to the Mediterranean area. It has been cultivated for more than 2,000 years. Parsley is a member of the Umbelliferae family that has been employed in the food, pharmaceutical, perfume, and cosmetics industries (Lopez et al., 1999). It is widely distributed in Egypt and grown in gardens and fields. Parsley has been reported to have a number of possible medicinal attributes including, antimicrobial, (Wong and Kitts, 2006) antianemic, menorrhagic, (Baytop, 1984) anticoagulant, antihyperlipidemic, antihepatotoxic, (Ozturk et al., 1991) antioxidant,
Ginseng is one of the most popular medicinal plants, the roots of which have long been traditionally used for strengthening immunity, providing nutrition and recovering health from fatigue (Blumenthal, 2000). The pharmaceutical activities of ginseng roots have been proven recently by many investigators, and ginseng has become the famous medicinal plant all over the world. Ginseng roots contain various pharmaceutical components ginsenosides (saponins), polyacetylenes, polyphenolic compounds and acidic polysaccharides, and among the components, ginsenosides are the most pharmaceutically active (Kim et al., 2005). Until now, 38 ginsenosides have been isolated from ginseng roots, with five major ginsenosides (ginsenosides Rb1, Rb2, Rc, Re and Rg1) constituting more than 80% of the total ginsenosides (Kim et al, 1999). Moreover, ginseng intake was associated with a decreased risk for most cancers including carcinomas of the esophagus, stomach, colon, pancreas, lung and liver (Matsuda, 1986; Jeong et al., 1997; Dayan and Paine, 2001). In the recent years, many studies have aimed to convert major ginsenosides to the more active minor ginsenosides using heating, acid treatment, enzymatic and microbial conversion (Kim et al., 2005). The minor ginsenoside, Rd, has been known to enhance the differentiation of neural stem cells, while other ginsenosides induce no differentiation of neurons (Shi et al., 2005) and are known to protect neural systems against neurotoxicity by attenuating NO overproduction (Choi et al., 2003, Mannaa et al., 2006). The pharmaceutical property of ginseng roots in protecting neurons from neurotoxic chemicals, such as kainic acid, is attributed mostly to ginsenoside Rd (Lee et al., 2003). Ginsenoside Rd has been known to protect kidney from apoptosis and DNA fragmentation caused by chemical drugs and cancer drugs (Yokozawa and Owada, 1999; Yokozawa and Dong, 2001, Mannaa et al., 2006).

Zearalenone (ZEN) is a non-steroidal estrogenic mycotoxin present in corn, as well as food mixture for farm animals (Hagler et al., 1984; Molto et al., 1997; Placinta et al., 1999). Studies in various species (rodents, pigs and monkeys) have shown that ZEN and its metabolites have estrogenic and anabolic activities (Etienne and Dourmad 1994) and it has cytotoxic effects to mammalian cell cultures (Cetin and Bullerman, 2005). ZEN was associated with hyperestrogenism and several physiological alterations of the reproductive tract in several laboratory animals (mice, rat, guinea-pig, hamster, rabbits) (Creppy, 2002). ZEN ingestion through contaminated feed is associated with decreased reproductive capacity and other hyperestrogenic conditions, such as vaginal swelling, enlargement of mammary glands, and testicular atrophy in farm animals (Wannemacher et al., 2000). The strong estrogenic effect of ZEN is due to its competition with 17 B-estradiol in the binding to cytosolic estrogen receptors present in the uterus, mammary gland, hypothalamus and pituitary gland (Kuiper-Goodman et al., 1987; Creppy, 2002). Several toxic effects of ZEN were demonstrated, it induces apoptosis, DNA fragmentation (Kim et al., 2003; Abid-Essafi et al., 2003), micronuclei production (Ouanes et al., 2003), chromosome aberration (IARC, 1993; Ouanes et al., 2005) and DNA-adduct formation (Pfohl-
Leszkowicz et al., 1995). These toxic effects are unlikely to be due to the estrogentic activity of ZEN. Several processes are known to play a role in the molecular events leading to cell damage. The carcinogenicity of ZEN is still questionable since it is classified by IARC in group 3, i.e. not classifiable as to its carcinogenicity to humans (IARC, 1993; Yosida and Amano, 1965).

The objectives of the current study were to evaluate the potential of panax ginseng extract and parsley oil against the cytotoxic effects and the reproductive disorders induced by ZEN in male mice.

### Materials And Methods

**Chemicals:** ZEN standards was purchased form Sigma Chemical Co. (St. Louis, MO). Testosterone Kit was purchased from ELISA (Enzyme Linked Immuno System Assay), Italy. All other chemical were of the highest purity commercial available.

Parsley oil were purchased from El-Captain Company (CAP PHARM), 6th October, Egypt.

Panax ginseng: The standardized *Panax ginseng* extract EFLA400 (Phoenix ginseng) (Batch No. 303298) of Panax ginseng C. A. Mayer was prepared according to the published procedure (Korean patent 0425022, PCT/KR2003/000003) and was supplied from Lotte Group R & D Centre (Seoul, Korea). The content of ginsenoside Rg3, a pharmacologically active ingredient of Phoenix ginseng, was 3.6% (w/w) as determined by HPLC.

**Animals:** A total of 108 adult male Swiss albino mice (eight-week old, weighing 25 ± 2 gm) purchased from Animal House Colony, NRC Dokki, Giza, Egypt. Animals were maintained on standard laboratory diet (protein, 16.04%; fat, 3.63%; fiber, 4.1%; and metabolic energy, 0.012 MJ) and water *ad libitum*. After an acclimation period of 1 week, animals were divided into nine groups (12 mice/group) and housed in filter-top polycarbonate cages (six animals/cage) the animals were maintained in an environmentally standard controlled.

**Experimental design:** Animals within different treatment groups were treated as follow: group 1 untreated control; group 2, treated orally with corn oil; group 3, treated orally with Korean panax ginseng extract (40 mg/kg b.w) suspended in water; group 4, treated orally with parsley oil (0.6 ml/kg b.w); group 5, treated orally with panax ginseng extract plus parsley oil; group 6, treated orally with ZEN (10 µg/kg b.w) in corn oil; group 7, treated orally with ZEN (10 µg/kg b.w) plus panax ginseng extract; group 8, treated orally with ZEN plus parsley oil; and group 9, treated orally with ZEN plus panax ginseng extract and parsley oil.

All groups were divided into two subgroups A and B. Animals in subgroup A (within all treatment groups) were used for the determination of blood serum testosterone level and chromosomes analysis of germ cells and treated with the respective treatment for 15 days. On day 16 blood samples were collected for testosterone determination then animals were sacrificed by cervical dislocation and testes were removed for chromosomes analysis of germ cells. Whereas animals in subgroup B were used for the determination of sperm abnormality and treated twice/day with their respective doses for one week and sacrificed after 30 days and epididymis were removed for the sperm abnormality study.

Chromosome analysis of germ cells was carried out according to the method described by Evans et al., (1964) and modified by Russo (2000). For testosterone determination, blood samples were collected from all animals in subgroup A from retro-orbital venous plexus (Scherner, 1967) then left to clot, centrifuged at 5000 rpm under cooling for 10 min and serum was separated for testosterone determination by enzyme linked immunoassay procedure as described by Parker (1981).

The technique of Wyrobek et al., (1984) was adopted for sperm abnormality study with minor modifications. Epididymis (free of fats, vas deferens and other tissues) from each side of testis of either control or treated mice was dissected out and the inner content squeezed out into 10 ml of 0.87 % normal wormed saline separately. The content was thoroughly shaken, filtered...
through a silken cloth and dropped on grease-free clean slides to determine the movement and swimming ability of sperm (motility) using microscope. Spermatozoa were counted using haemocytometer and a drop of a hemogenate smeared on a cleaned slide, allowed to air dry and stained by Eosin Yellow to determine the head and tail abnormality of sperms.

Statistical Analysis: Students’ t-test was conducted as per standard procedure for determining the significance level of the differences between treated and control data according to Parker, (1979).

Results

The results of the cytogenetic study (Table 1) revealed that treatment with ZEN resulted in a significant increase in frequency of aberrations in spermatocytes (19.0 ± 1.0) whereas, animals treated with either parsley or ginseng extract were nearly as the control groups. Cotreatment with parsley or ginseng extract plus ZEN showed a significant decrease (p<0.01) in the aberrations resulted from ZEN (11.1 ± 1.2 and 9.8 ± 0.1 respectively). Although a marked inhibition was observed in the group received ZEN and treated with ginseng plus parsley (8.2 ± 0.7), the total aberrations was still significantly higher than the control groups (Fig. 1).

The present study showed that serum testosterone levels were significantly decrease in male mice treated with ZEN compared to the control groups (Fig.2). Treatment with parsley alone or parsley plus ginseng extract caused a significant increase in the testosterone concentration compared to those of the control groups. Whereas, insignificant increase was found in animals with Phoenix ginseng alone compared to the control groups. On the other hand, the combined treatment of ZEN plus Phoenix ginseng, parsley or Phoenix ginseng plus parsley resulted in an amelioration of the testosterone level. It is of interest to mention that the recovery was obvious in the group treated with Phoenix ginseng plus parsley than in the ZEN plus either Phoenix ginseng or parsley oil.

The motility of cauda epididymal sperm of group treated with ZEN showed a significant decrease (P<0.001) compared to those of the control groups. The combined treatment with Phoenix ginseng plus ZEN resulted in a significant improvement in the sperm motility compared with the ZEN alone group although the values were still lower than the control groups. On the other hand, animals treated with ZEN plus parsley oil alone or ZEN plus parsley oil and Phoenix ginseng showed a complete recovery in the sperm motility and were comparable to the control groups (Table 2).

The sperm count in ZEN-treated group showed a significant decline compared to those of the control groups. Whereas, in animals treated with ZEN plus Phoenix ginseng, ZEN plus parsley oil or ZEN plus Phoenix ginseng and parsley showed a significant recovery (p<0.01) compared to the ZEN alone treated group and the improvement was pronounced in the later two groups.

The current results clearly indicated that treatment with either parsley or Phoenix ginseng alone or in combination had no influence to induced sperm abnormalities (Fig.3). Animals treated with ZEN alone showed a significantly increase (29.5%) in the frequency of abnormal sperm compared to the control groups. Treatment with both parsley oil and Phoenix ginseng alone or in combination to ZEN-treated mice considerably reduced sperm abnormality frequencies. The maximum efficacy being found in the animals received the combined treatment plus ZEN (8.2 %). In spite of this reduction, the percentage of sperm abnormality was still significantly higher than the control group. Various morphological sperm abnormalities in head and tail were recorded in both control and treated mice (Table3).
Antioxidant effects of parsley and *Panax ginseng*..........................

Table (1): The main structure aberration in spermatocytes of mice in different treatments (mean ± SE)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>X-Y univalent</th>
<th>Autosomal break</th>
<th>Chain</th>
<th>Total aberration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>0.4 ± 0.3</td>
<td>1.6 ± 0.5</td>
<td>0</td>
<td>2.0 ± 0.8</td>
</tr>
<tr>
<td>Corn oil</td>
<td>0.3 ± 0.1</td>
<td>0.9 ± 0.4</td>
<td>0</td>
<td>1.2 ± 0.6</td>
</tr>
<tr>
<td>Ginseng</td>
<td>0.9 ± 0.5</td>
<td>2.0 ± 0.5</td>
<td>0.3 ± 0.1</td>
<td>3.2 ± 0.48</td>
</tr>
<tr>
<td>Parsley</td>
<td>0.5 ± 0.1</td>
<td>1.8 ± 0.3</td>
<td>1.1 ± 0.25</td>
<td>3.4 ± 0.15</td>
</tr>
<tr>
<td>Ginseng + Parsley</td>
<td>1.4 ± 0.5</td>
<td>1.4 ± 0.6</td>
<td>1.0 ± 0.38</td>
<td>3.8 ± 1.1</td>
</tr>
<tr>
<td>ZEN</td>
<td>5.6 ± 1.5</td>
<td>7.6 ± 0.5</td>
<td>5.8 ± 1.5</td>
<td>19.0 ± 1.0**</td>
</tr>
<tr>
<td>ZEN + Ginseng</td>
<td>3.2 ± 0.8</td>
<td>0.8 ± 0.3</td>
<td>3.1 ± 0.53</td>
<td>11.1 ± 1.2*</td>
</tr>
<tr>
<td>ZEN + Parsley</td>
<td>3.3 ± 1.5</td>
<td>4.0 ± 0.45</td>
<td>2.5 ± 0.6</td>
<td>9.8 ± 0.1*</td>
</tr>
<tr>
<td>ZEN + Ginseng+parsley</td>
<td>2.5 ± 0.45</td>
<td>3.6 ± 0.71</td>
<td>2.1 ± 0.54</td>
<td>8.2 ± 0.7*</td>
</tr>
</tbody>
</table>

ZEN: 5.6 ± 1.5 7.6 ± 0.5 5.8 ± 1.5 19.0 ± 1.0**
ZEN + Ginseng: 3.2 ± 0.8 0.8 ± 0.3 3.1 ± 0.53 11.1 ± 1.2*
ZEN + Parsley: 3.3 ± 1.5 4.0 ± 0.45 2.5 ± 0.6 9.8 ± 0.1*
ZEN + Ginseng + parsley: 2.5 ± 0.45 3.6 ± 0.71 2.1 ± 0.54 8.2 ± 0.7*

Table (2). Cauda epididymal sperm count, motility and abnormality percentage.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Sperm Count X10^6</th>
<th>Sperm Motility (%)</th>
<th>Sperm Abnormality (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>35.63 ± 0.45</td>
<td>70.28 ± 0.58</td>
<td>1.4</td>
</tr>
<tr>
<td>Corn oil</td>
<td>33.2 ± 0.53</td>
<td>75.19 ± 0.43</td>
<td>2.9</td>
</tr>
<tr>
<td>Ginseng</td>
<td>38.0 ± 0.59</td>
<td>80.11 ± 0.48</td>
<td>1.9</td>
</tr>
<tr>
<td>Parsley</td>
<td>42.3 ± 0.45</td>
<td>86.88 ± 0.6</td>
<td>2.3</td>
</tr>
<tr>
<td>Ginseng + Parsley</td>
<td>43.0 ± 0.81</td>
<td>88.64 ± 0.42</td>
<td>2.9</td>
</tr>
<tr>
<td>ZEN</td>
<td>20.52 ± 0.45</td>
<td>42.46 ± 0.91</td>
<td>29.5</td>
</tr>
<tr>
<td>ZEN + Ginseng</td>
<td>30.45 ± 0.48</td>
<td>60.94 ± 0.73</td>
<td>15.3</td>
</tr>
<tr>
<td>ZEN + Parsley</td>
<td>38.25 ± 0.81</td>
<td>68.63 ± 0.54</td>
<td>12.0</td>
</tr>
<tr>
<td>ZEN + Ginseng + parsley</td>
<td>43.34 ± 0.74</td>
<td>75.74 ± 0.75</td>
<td>8.2</td>
</tr>
</tbody>
</table>

*P<0.01, ** P<0.001

Table (3). Effect of different treatments on types of sperm abnormality in mice (means ± SE)

<table>
<thead>
<tr>
<th>Groups</th>
<th>Tail abnormality</th>
<th>Head abnormality</th>
<th>Total abnormality</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Without hock</td>
<td>Banana</td>
<td>Amorphous</td>
</tr>
<tr>
<td>Control</td>
<td>1.0 ± 0.55</td>
<td>2.3 ± 0.38</td>
<td>2.0 ± 0.6</td>
</tr>
<tr>
<td>Corn oil</td>
<td>2.3 ± 0.38</td>
<td>3.0 ± 0.2</td>
<td>1.3 ± 0.54</td>
</tr>
<tr>
<td>Ginseng</td>
<td>1.3 ± 0.45</td>
<td>3.0 ± 0.15</td>
<td>2.5 ± 0.38</td>
</tr>
<tr>
<td>Parsley</td>
<td>2.1 ± 0.5</td>
<td>2.4 ± 0.45</td>
<td>3.4 ± 0.45</td>
</tr>
<tr>
<td>Ginseng + Parsley</td>
<td>3.0 ± 0.48</td>
<td>5.1 ± 0.63</td>
<td>4.3 ± 0.82</td>
</tr>
<tr>
<td>ZEN</td>
<td>29.2 ± 1.5</td>
<td>52.4 ± 1.75</td>
<td>40.5 ± 2.5</td>
</tr>
<tr>
<td>ZEN + Ginseng</td>
<td>16.0 ± 0.9</td>
<td>21.5 ± 0.92</td>
<td>24.3 ± 1.8</td>
</tr>
<tr>
<td>ZEN + Parsley</td>
<td>12.0 ± 0.75</td>
<td>17.0 ± 0.78</td>
<td>19.5 ± 1.0</td>
</tr>
<tr>
<td>ZEN + Ginseng + Parsley</td>
<td>10.5 ± 0.45</td>
<td>10.0 ± 1.1</td>
<td>9.5 ± 0.75</td>
</tr>
</tbody>
</table>
Fig. (1): Spread spermatocytes metaphases showing a- Normal metaphase, b- X-Y univalent, and c- autosomal break.

Fig. (2): Concentration of testosterone in serum of mice treated with ZEN with or without phoenix ginseng, parsley oil or phoenix ginseng plus parsley.

Fig. (3): Showing different sperm shapes abnormality: (a) amorphous head, (b) banana head, (c) head without hock, (d) normal sperm, and (e) sperm with coiled tail.
Antioxidant effects of parsley and *panax ginseng*.................

**Discussion**

The present investigation was carried out to explore the possible ameliorative role of phoenix ginseng and parsley herbs on ZEN-induced genotoxic effects of germ cells chromosomes, sperm abnormality as well as testosterone level in male mice. The selection of dose of ZEN and parsley oil was literature based (Ouanes *et al.*, 2005 and Nielsen *et al.*, 1999 respectively), and the selection of dose of phoenix ginseng was based on our previous work (Mannaa *et al.*, 2006). Different herbal plants were potentially offer distinct qualities of materials used for cuisine, food preservation and herbal medicine. Numerous studies have suggested that phenolic compounds in plants constitute a major class of secondary plant metabolites with bioactive potential attributed to their antioxidant and antibacterial activities (Kaur and Kapoor, 2002). Flavonoids, the major group of total phenolic compounds, are found in greater concentration in parsley and ginseng (Justesen and Knuthsen 2001).

ZEN is a fusariotoxin occurring worldwide in cereals, animal food and forages (Placinta *et al.*, 1999) that adversely affects reproduction (Creppy, 2002) thus, ZEN was first known to be a potent disrupter of the reproductive system. It is also associated with several human diseases of unknown etiology (Placinta *et al.*, 1999). Many studies have been carried out in order to show whether or not ZEN induced clastogenic effects. The induction of chromosome aberrations by ZEN was demonstrated for the first time by Tennant *et al.* (1987). Recently, Lioi *et al.*, (2004) demonstrated that ZEN induced a significant increase in the aberration frequency in bovine lymphocyte cultures. In addition, very convincing data do exist that show a capability of ZEN to induce DNA adducts in mice (Pfohl-Leszkowicz *et al.*, 1995), DNA fragmentation in cell cultures (Abid-Essefi *et al.*, 2003), micronucleus formation and apoptosis both in vivo and in vitro (Ouanes *et al.*, 2003). According to Ouanes *et al.*, (2005) the chromosome aberrations induced by ZEN could be attributed to the parent compound itself as well as to its metabolities, especially α-zearalenol and α-ZENalanol, which both have demonstrated mutagenic potency (Scheutwinkel *et al.*, 1986; Metzler and Pfeifer, 2001). These effects can be also attributed to active oxygen species generated by ZEN (Abid-Essefi *et al.*, 2004).

The findings of the current study revealed that treatment with ZEN resulted in a significant decrease in testosterone concentration. This effect suggests that ZEN had harmful effects on the endocrine system as well as the stressful of testicular cells. In this regards, Whitehead and Lacey (2003) reported that ZEN increased the enzymes that convert androgens to estrogens. Moreover, ZEN was found to decrease the size and weight of testis and resulted in the decrease of testosterone secretion by the cells (Gajecki, 2002; Kim *et al.*, 2003) and the inhibition of other endocrine glands mainly the pituitary gland (Thomas *et al.*, 2000). In the current study, treatment with ZEN resulted in a significant increase in the frequency of abnormal sperm and meiotic germ cells. The positive correlation between cytogenetic damage in germ cells and sperm abnormalities was previously reported in man and in mice (Kim *et al.*, 2003). Precocious separation of X-Y chromosome has been discussed as a mechanism of male sterility (Ford, 1969) however; the effect of ZEN on germ cells may resulted in the reduction of fertility. El-Makawy *et al.* (2001) reported that ZEN was shown to increase chromosome breaks in mouse spermatocytes at a dose of 10µg/kg and this results confirmed our present data. Moreover, ZEN has been reported to disturb spermatogenesis and decrease fertility in male rats fed naturally contaminated corn (IARC, 1993).

The present results revealed that ZEN induces severe stress on the testis and on the endocrine function in mice including the testis itself and indirectly on the pituitary gland. The treatment with either parsley or phoenix ginseng alone or in combination resulted in significant improvements in all the tested parameters meanwhile, the combined treatment was more effective than
the individual treatment. Parsley or/and ginseng alone or in combination caused a significant decrease in total chromosomal aberrations, sperm abnormalities and increase in testosterone level and sperm counts and motility. The antioxidant activity of parsley has been reported previously. Zheng et al., (1992) reported that parsley oil is rich in myristicin which showed a high activity as an inducer of the detoxifying enzyme GST in the liver and small intestinal mucosa of female mice. Reduction of myristicin yielded dihydromyristicin that retained the GST-inducing activity. Fejes et al. (1998) indicated that parsley oil contain flavonoids (apiin, luteolin-, apigenin-glycosides), essential oil (apiole, miriszticin), cumarines, (bergapten, imperatorin) and vitamin C. The protective role of parsley oil may be attributed to its higher content of these flavonoids which either scavenge free radicals or increase the production of GST. Ozsoy-Sacan et al. (2006) concluded that, parsley extract probably, due to its antioxidant property, has a protective effect against hepatotoxicity caused by diabetes and have free radical scavenging and membrane protective effects (Fejes et al., 2000). In the same regards, Nielsen et al., (1999) indicated that treatment with parsley oil resulted in increased levels of glutathione reductase and SOD activity. The protective effects of flavonoids may occur through inhibitory effect on CYP1A1/2 among CYP enzymes involved in ZEN metabolism by rat microsomes as well as the decreased DNA damage and activating the phase II enzymes glutathione S-transferase (GST) and GSH peroxidase (GSH-Px). These results suggest that parsley oil is capable of counteracting ZEN toxicity by suppressing cytochromes P-450 mediated bioactivation of the mycotoxin (Abdel-Wahhab and Aly, 2003, 2005). The increased level of testosterone reported in the current study accompanied with the increase of sperm counts is supported by the previous reports of (Hileman and Jackson 1999; McDonald and Capen, 1989) who stated that the testosterone hormone promotes the growth development and secretory activity of the accessory sex organs of the male.

The current study revealed that phoenix ginseng exhibits a protective role against ZEN-induced disturbance in testicular function. Kumar et al., (2003) and Kang et al., (2002) observed that ginseng extract provides the protection of the testis by reflecting a significant decrease in testicular acid phosphatase activity, LPO level and significant increase in alkaline phosphatase activity. It has been reported that ginseng extract contains active components which are well known to suppress lipid peroxidation and reduce the cellular damage. Moreover, Kim et al., (1993) reported that water fraction and alkaloid fraction of ginseng may reduce cell damage, especially the damage to DNA molecules, caused by gamma rays and thus playing a role in the repair of regeneration process of damaged cells. They also concluded that it is possible that ginseng reduces DNA damage by antiradical action. Thus the present study suggests that ZEN toxicity may be reduced through the inhibition of lipid peroxidation by phoenix ginseng extract, which in turn may reflected by a decline of testicular acid phosphatase and LPO level and elevated alkaline phosphatase activities. Generally, the protective and therapeutic effects of Phoenix ginseng on atrophy and testicular damage induced by ZEN, providing evidence that ginseng might be a useful agent in preventing and treating testicular damage induced by environmental pollutants (Kim et al., 1999).

Our results indicated that phoenix ginseng improved the sperm count and sperm motility. In this regards, Hwang et al., (2004) reported that ginseng improves the survival rate and sperm quality in guinea pigs exposed to TCDD and stimulates the spermatogenesis (Yamamoto et al., 1977). This action may be attributed to the increase in LH secretion which acts directly on the pituitary gland (Tsai et al., 2003). Furthermore, Fahim et al., (1982) reported that rats that received 5% ginseng experienced a significant increase in blood testosterone level.

In conclusion, the current results revealed that ZEN induced a stressful on the testis function included, increased in chromosomes aberration and sperm abnormality, decrease in sperm counts and motility and testosterone concentration. Both parsley oil and phoenix ginseng proved to have a
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A protective effect singly or in combination and the combined treatment was more effective. Their protective role may be attributed to the higher ability to scavenge free radicals and protect the cell membranes from the lipid peroxidation and their effect on endocrine system as well as the antagonistic effects to ZEN. Generally, the protective role of both herbs can be explained by two mechanisms, the first one is the antioxidant effect of parsley by acting as a radical scavenger (Fejes et al., 2000; Gazzani, 1994 and Ramadan et al., 2003) and the competition effect of ginseng for binding the ZEN receptors (Gray et al., 2004). The efficiency of the ginseng was likely also to be saturated from the dose of ginseng.

References


Antioxidant effects of parsley and *panax ginseng* .........................


التأثيرات المضادة للأكسدة للبقدونس ومستخلص الجينسيجين المعير بالجينيسونزيد ضد التغيرات المستحدثة في الوظائف التناسلية لذكور الفئران

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تم في هذه الدراسة تقييم التأثير الوقائي لزيت البقدونس ومستخلص الجينسيجين ضد التسمم الخلوي الناتج عن الزيراليتون حيث استخدمت عدد 108 من ذكور الفئران الناضجة قسمت إلى تسعة مجموعات شملت المجموعة المقارنة والمجموعة المعالمة بزيت البقدونس (0.6 ملجم/كم وزن جسم) والمجموعة المعالمة بمستخلص الجينسيجين (40 ملجم/كم وزن جسم) والمجموعات المعالمة بزيت البقدونس ومستخلص الجينسيجين مع بدأ الزيت البلاينون (10 ميكروجرام/كم وزن جسم). قسمت كل مجموعة تجريبية إلى تحت مجموعة (أ) استخدمت في قياس التستيرون في السيرم والتشوهات الكروموسومية وع wolmt لمدة أسبوعين بينما استخدمت تحت المجموعة (ب) لدراسة التشوهات في الحيوانات المنوية وع wolmt بجرعتين يوميا لمدة أسبوع ثم ذبحت بعد 30 يوما. أوضحت النتائج أن المعلامة بالزيراليتون نتج عنها نقص معنوي في تركيز التستيرون في السيرم والعدد الكلي للحيوانات المنوية بينما تسببت في زيادة معنوية في عدد الحيوانات المنوية المشوهة وعدد التشوهات الكروموسومية في الخلايا التناسلية. أظهرت النتائج أيضًا أن الحيوانات المعدلة بزيت البقدونس أو مستخلص الجينسيجين بصرف بما كانت طبيعية ومماثلة للمجموعة المقارنة في كل القياسات محل الدراسة. كما أثبتت النتائج أن المعلامة بالزيراليتون مع كل من زيت البقدونس أو مستخلص الجينسيجين أو كلاهما معا أدت إلى حدوث تحسينات معنوية في كل القياسات تحت الدراسة إلا أن المعلامة بزيت البقدونس كانت أكثر فعالية عن مستخلص الجينسيجين كما أن المعلامة بالزيراليتون مع زيت البقدونس ومستخلص الجينسيجين معا كانت أكثر فعالية من المعلمتين المنفردين. تستخلص من هذه الدراسة أن كل من زيت البقدونس ومستخلص الجينسيجين لهما تأثير وقائي فعال ضد التغيرات الناتجة عن الزيراليتون وأن المعلامة بالمستخلصين معا أدت إلى نتائج أكثر فعالية في الحماية ضد التأثيرات الناتجة عن الزيراليتون.