International Science and Technology Journal
المجلة الدولية للعلوم والتقنية
Volume 36 العدد
Part 1 المجلد
المجلة الدولية للعلوم والتقنية
International Science and Technology Journal
ISTJ

http://www.doi.org/10.62341/smfa1423

Received	**2025/02/15**	**تم استلام الورقة العلمية في**
Accepted	**2025/03/12**	**تم قبول الورقة العلمية في**
Published	**2025/03/14**	**تم نشر الورقة العلمية في**

Studying the Ability of *Panax Ginseng* to Defend Liver Parameters of Male Rabbits from the Damaging Impacts of Stannous Chloride

Salma S. M. Hamed[*1], Marfoua. S. Ali[1], Fayrouz Khaled[2] Aisha. M. Taib.[1]

[1] Zoology Department, Faculty of Science, Omar Al-Mokhtar University, El-Beida, Libya
[2] Department of Chemistry, Faculty of Science, Omar Al-Mukhtar University, El -Beida-Libya

Salma.hamed@omu.edu.ly

Abstract

The current investigation aimed to determine if *Panax ginseng* might shield male rabbit liver against stannous chloride ($SnCl_2$)-induced liver damage. 20 rabbits were randomly divided into 4 equal-sized groups comprising 5 rabbits each. The first group (control) was given the same amount of corn oil only. The effects of *P. ginseng* (100 mg per kg of body weight) and $SnCl_2$ (20 mg per kg of body weight) were investigated in the second and third groups, respectively. The impact of *P. ginseng* + $SnCl_2$ was investigated in the fourth group. For 12 weeks, the animals received oral treatment every day. The findings indicated that "AST, ALT, and ALP" activities in the liver were considerably "$P < 0.05$" raised by *P. ginseng*, although serum "AST, ALT, and ALP" activities were dramatically decreased by P. ginseng therapy alone. On the other hand, compared to the control, $SnCl_2$ considerably "$p < 0.05$" decreased "AST and ALT" activities in the liver's plasma while considerably "p 0.05", raising levels of "AST, ALT, and ALP" activities. Following *P. ginseng* therapy, the levels of "T. bilirubin" were considerably "$P < 0.05$" lower. However, treatment with $SnCl_2$ significantly increased levels of "T. bilirubin". Administration of *P. ginseng* in combination with $SnCl_2$ minimized and alleviated the hazardous effect of $SnCl_2$ on most of the measured parameters. In conclusion, *P. ginseng* could effectively protect against stannous chloride ($SnCl_2$) toxicity.

International Science and Technology Journal
المجلة الدولية للعلوم والتقنية
Volume 36 العدد
Part 1 المجلد
المجلة الدولية للعلوم والتقنية
International Science and Technology Journal
ISTJ
http://www.doi.org/10.62341/smfa1423

Keywords: Stannous chloride; *Panax ginseng*; AST; ALT; ALP; Male rabbit liver.

دراسة قدرة نبات *Panax ginseng* على حماية معايير الكبد لدى ذكور الأرانب من التأثيرات الضارة لكلوريد القصدير

سالمة س. م. حامد*[1]، مرفوعة س. علي[1]، فيروز خالد[2]، عائشة م. طيب[1]

[1] قسم علم الحيوان، كلية العلوم، جامعة عمر المختار، البيضاء، ليبيا
[2] قسم الكيمياء، كلية العلوم، جامعة عمر المختار، البيضاء، ليبيا
Salma.hamed@omu.edu.ly

الملخص:

هدفت الدراسة الحالية إلى تحديد ما إذا كان ***Panax ginseng*** قد يحمي كبد الأرانب الذكور من تلف الكبد الناجم عن كلوريد القصدير. تم تقسيم 20 أرنبًا بشكل عشوائي إلى 4 مجموعات متساوية الحجم تضم كل منها 5 أرانب. أعطيت المجموعة الأولى (المجموعة الضابطة) نفس الكمية من زيت الذرة فقط. تم التحقيق في تأثيرات ***Panax ginseng*** (100 مجم لكل كيلوجرام من وزن الجسم) وكلوريد القصدير (20مجم لكل كيلوجرام من وزن الجسم) في المجموعتين الثانية والثالثة على التوالي. تم التحقيق في تأثير ***Panax ginseng*** + كلوريد القصدير في المجموعة الرابعة. لمدة 12 أسبوعًا، تلقت الحيوانات علاجًا عن طريق الفم كل يوم. أشارت النتائج إلى أن أنشطة "AST و ALT و "ALP في الكبد زادت بشكل كبير " $P < 0.05$" بواسطة ***Panax ginseng***، على الرغم من أن أنشطة "AST و ALT و "ALP في المصل انخفضت بشكل كبير عن طريق علاج ***Panax ginseng*** وحده. من ناحية أخرى، وبالمقارنة مع المجموعة الضابطة، أدى كلوريد القصدير إلى انخفاض كبير في أنشطة "AST و "ALT في بلازما الكبد بنسبة "$p < 0.05$"، بينما أدى إلى رفع مستويات أنشطة "AST و ALT و "ALP بنسبة . "$p< 0.05$"وبعد العلاج بال ***Panax ginseng*** كانت مستويات "T. Bilirubin" أقل بنسبة ."$p < 0.05$" ومع ذلك، أدى العلاج بكلوريد القصدير إلى زيادة كبيرة في مستويات "T. Bilirubin". أدى تناول ***Panax ginseng*** بالاشتراك مع كلوريد القصدير إلى تقليل وتخفيف التأثير الخطير لكلوريد القصدير على معظم المعلمات

http://www.doi.org/10.62341/smfa1423

المقاسة. وفي الختام، يمكن لل ***Panax ginseng*** أن يحمي بشكل فعال من سمية كلوريد القصدير.

الكلمات المفتاحية :كلوريد القصدير; ***Panax ginseng*** ; AST; ALT; ALP; كبد الأرانب الذكور.

Introduction

The earth's crust contains tin (Sn), a heavy metal that occurs naturally with an average concentration of 2 mg/kg (Raghubanshi *et al.*, 2024). Cans of food, drinks, and aerosols are lined with Sn metal. is widely utilized in alloys including bronze, pewter, and type metal, as well as in more specific alloys used in aviation engineering and plated containers. It is disseminated across several tissues and nutrients and is frequently used in daily life. Numerous investigations have mainly demonstrated that high dietary tin levels cause the hepatic antioxidant's activities to diminish (Johnson and Greger, 1982; Reicks and Rader, 1990). "Tin chloride, tin sulfide, and tin oxide," known as inorganic tin compounds, are formed when tin is mixed with chlorine, sulfur, and oxygen. Moreover, food additives, toothpaste, soaps, scents, and colors all include them. Moreover, tin and carbon can react to form organic tin compounds, like "triphenyltin, tributyltin, and dibutyltin.". These substances make paints, food packaging, plastic pipes, plastics, insecticides, wood preservatives, and rodent (mice and rats) repellents (Raghubanshi *et al.*, 2024). Organic tin compounds are frequently synthetic products that are not found in the natural environment (Raghubanshi *et al.*, 2024). Along with the lymph nodes, skin, tongue, liver, kidneys, spleen, and lungs, inorganic tin is mostly distributed in bone. Animal studies have shown that inorganic Sn has several hazardous consequences once it enters the body, including neurotoxicity, decreased calcium content in bone, genotoxicity, immunotoxicity, and nephrotoxicity (Aitio *et al.*, 2015; Howe and Watts, 2005). Anemia can be caused by stannous overload in addition to hepatic and renal problems (Harper, 2005). It has been said that the Sn ion is poisonous. Reactive oxygen species (ROS) generation seems to be the mechanism by which it is harmful. Transaminases are vital and significant enzymes that are involved in many biological processes. They play a function in amino acid catabolism and biosynthesis. The transfer of the aspartic acid amino group to α-ketoglutaric acid, which results in the formation of glutamic acid and oxaloacetic acid, is catalyzed by aspartate amino transaminases (AST). Glutamic acid and pyruvic

http://www.doi.org/10.62341/smfa1423

acid are produced when the amino group of alanine is transferred to α-ketoglutaric acid by the enzyme alanine amino transaminase (ALT). In animals, the liver is the primary location of amino acid breakdown. In animals, the liver is primarily where amino acid degradation takes place. Glutamate, which is generated when an amino group from many amino acids is changed into α-ketoglutarate, is oxidatively deaminated to produce ammonia (Center, 2007). Transaminase activity is considered to be a particular marker of liver damage or function; their blood and liver levels change greatly in response to xenobiotic toxicity (Amacher, 1998). Due to its perceived effectiveness and few side effects, the usage of herbal products is becoming more and more commonplace worldwide (Kam and Liew, 2002). *P. ginseng* is one of these herbs with a long history and is currently one of the most utilized medicinal plants worldwide (Ang-Lee *et al.*, 2001). Ginseng saponins, sometimes referred to as ginsenosides, are the primary and bioactive elements of ginseng and are primarily responsible for its pharmacological effects (Tung *et al.*, 2012). Ginseng saponins are known as ginsenosides and are the key constituents accountable for the pharmacological impacts of *ginseng* (Tung et al., 2012), which include "vasodilator, antioxidant, anti-inflammatory, and anti-cancer impacts" (Hofseth and Wargovich, 2007). According to Kitts *et al.* (2000), these ginseng characteristics are expected to have several positive benefits against organ damage. The hepatoprotective benefits of ginseng are mostly related to its antioxidative characteristics. The antioxidant defense system was strengthened by ginseng (Kim *et al.*, 2011).

The current investigation evaluates the ability of *P. ginseng* to reduce "$SnCl_2$" harmful effects on liver function measures in male rabbits.

Methodology

$SnCl_2$ (1 mg/ml) was brought in from the faculty of science's chemical department. This study employed *Panax ginseng* at 0.01 g/kg (Inoue *et al.*, 1999). 42 ml of regular saline is used to dissolve 7 grams of *Panax ginseng* powder, which was acquired from a local pharmacy.

Animals and the administration

There were 20 New Zealand White male rabbits utilized. Their initial weight was 1.641 ± 27.2 kg, and they were 6 months old.

http://www.doi.org/10.62341/smfa1423

During the 3-month study period, Animals were weighed weekly and water and food were available in libitum to animals housed in separate cages.

Procedures

20 rabbits were randomly divided into 4 equal-sized groups comprising 5 rabbits each. The first group was considered a control group and received the equivalent of 1 ml of the vehicle (corn oil) alone via oral gavage for 12 sequential weeks, twice a week. Rabbits in the second group received orally 0.01 g/kg of *Panax ginseng* (Inoue *et al.*, 1999). The rabbits of the third group were given 20 mg/kg/day of $SnCl_2$ (Yousef *et al.*, 2007). A mixture of $SnCl_2$ and *ginseng* was given orally to rabbits of group four.

Biochemical tests and enzyme activity

Blood was left at 25°C for 20 minutes to clot after withdrawal. Serum was extracted after centrifugation of specimens at 860×g for "20 minutes". and a kit approach was used to evaluate the liver's parameters. Livers were taken from the animals of each group after completion of the treatment, and they were all slaughtered by decapitation. Liver tissue was cut and homogenized." in a Potter-Elvehjem-type homogenizer with 1.15% KCl. in 10% w/v ice-cold sodium-potassium phosphate buffer (0.01 M, pH 7.4). For 20 minutes at 40°C, the homogenate was centrifuged at 10,000 xg". The kit's instructions utilized the liver's resulting supernatant for the same parameters.

Statistical analysis

Used "Graph Prism Pad and Minitab version 17" to analyze the data. Statistical significance was set by "ANOVA analysis and Tukey multiple comparison test". "$P < 0.05$" was considered statistically significant (Paulson, 2008).

Results

"Table 1" displayed the total means of the activities of "AST/GOT, ALT/GPT, ALP, and T. bilirubin" in serum. The levels of "AST, ALT, GGT, and T. bilirubin" activities were considerably "$p < 0.05$" decreased when *P. ginseng* was administered as the only treatment. On the other hand, as compared to the control, the $SnCl_2$ therapy markedly "$p < 0.05$" raised the levels of "AST, ALT, GGT, and T. Bilirubin" activities. These effects were reduced by mixing $SnCl_2$ and ginseng to reach levels of control. Only the level of ALP activity was increased in the group given ginseng and decreased in the group

http://www.doi.org/10.62341/smfa1423

given $SnCl_2$. All changes were observed from the fourth week of the experiment until its end. "Figures 1-5" illustrate this.

Table 2 displayed the total means of "AST, ALT, ALP, and T. Bilirubin" activities in the liver's plasma. When treated with *P. ginseng* only, observed a non-statistically significant "$p < 0.05$" increase in "AST and ALT" levels and a considerable increase in "ALP and T. bilirubin" levels compared to the control group. Comparing the $SnCl_2$ treatment to the control showed a non-significant rise in "AST and ALT" levels and a substantial drop in "ALP and T. Bilirubin" activities. These changes were reduced by mixing *P. ginseng* and $SnCl_2$; thus, control levels were reached.

Table 1: Illustrate the "AST, ALT, ALP, GGT, and T. Bilirubin" levels in the serum of male rabbits in the four groups.

Experimental groups				
Parameter	*Control* (Mean± SEM)	*Panax ginseng* (Mean± SEM)	*$SnCl_2$* Mean± SEM	*P. ginseng* +$SnCl_2$ Mean± SEM
AST (U/L)	41.23± 1.652^{a}	30.41 ± 1.823^{b}	47.09 ± 3.078^{a}	42.47 ± 1.209^{a}
ALT (U/L)	44.06±1.149^{b}	37.43 ± 1.088^{b}	57.04 ± 2.844^{a}	45.20 ± 1.286^{b}
ALP (U/L)	139.24±2.869^{ab}	158.36 ±3.712^{a}	129.08±6.106^{b}	142.94 ± 2.784^{b}
GGT (U/L)	7.35± 0.080^{b}	6.69± 0.224^{b}	7.77± 0.212^{a}	7.15± 0.111^{ab}
T. Bilirubin (mg/dl)	1.52±0.019^{a}	1.39±0.029^{b}	1.60±0.030^{a}	1.53±0.041^{a}

To express values, mean ± SEM is utilized. Not all mean values in a row that did not share the superscript letters "a, b, and c" had significant differences "$p < 0.05$.".

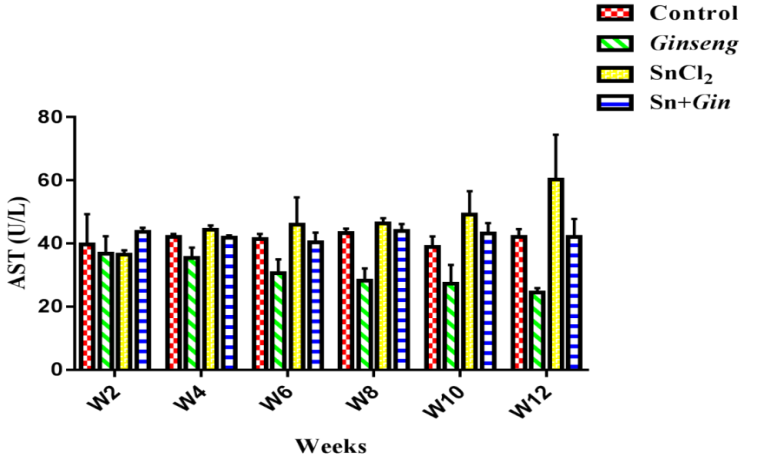

Fig. 1: Shows AST values "Mean± SEM" every two weeks in male rabbits in the four study groups.

http://www.doi.org/10.62341/smfa1423

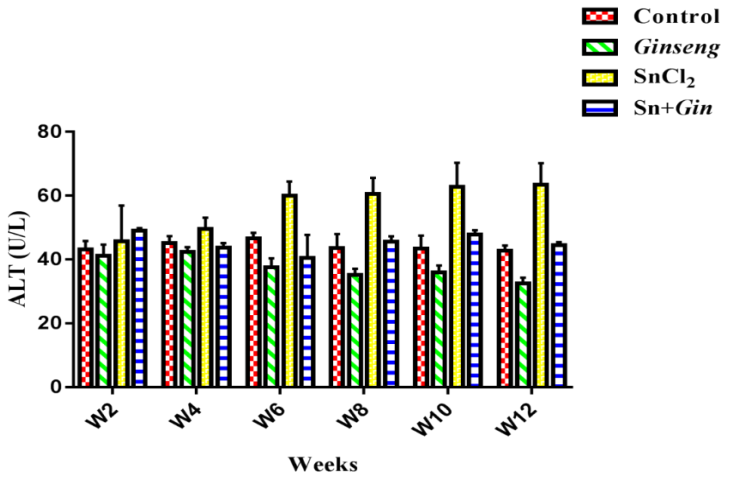

Fig. 2: Shows ALT values "Mean± SEM" every two weeks in male rabbits in the four study groups.

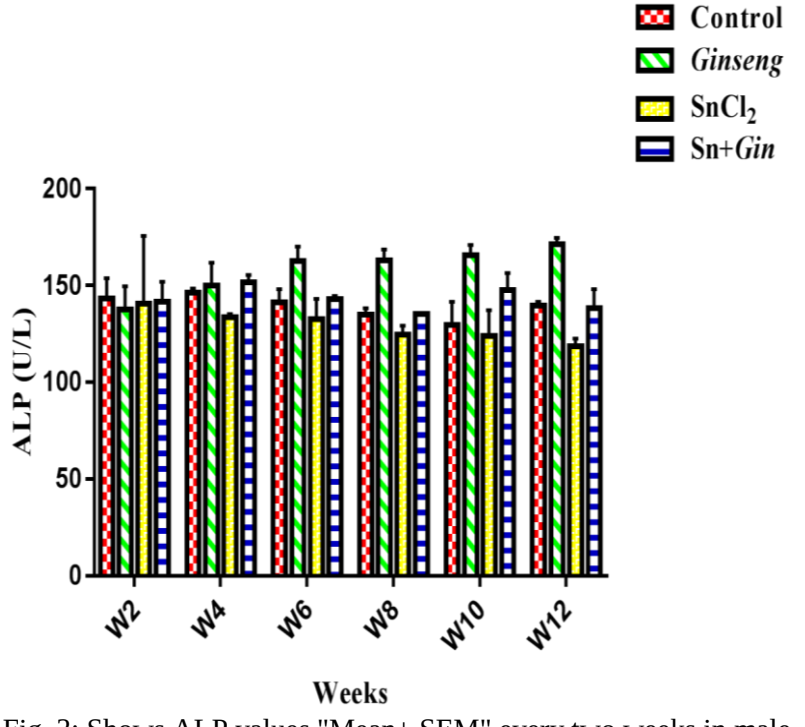

Fig. 3: Shows ALP values "Mean± SEM" every two weeks in male rabbits in the four study groups.

http://www.doi.org/10.62341/smfa1423

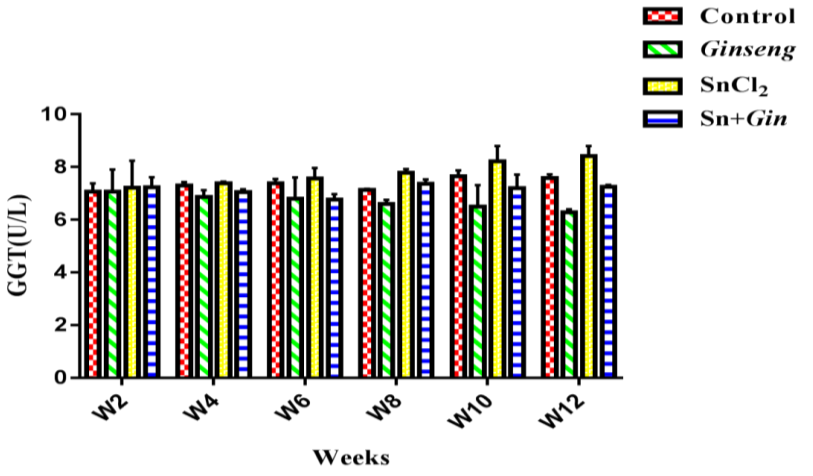

Fig. 4: Shows GGT values "Mean± SEM" every two weeks in male rabbits in the four study groups.

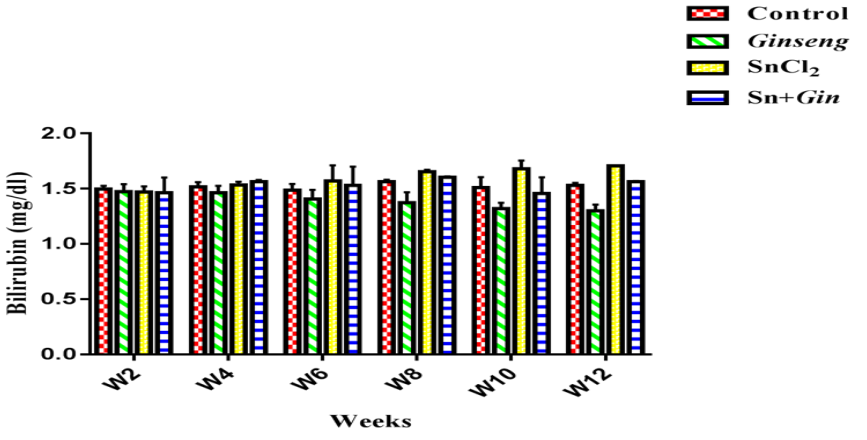

Fig. 5: Shows T. Bilirubin values "Mean± SEM" every two weeks in male rabbits in the four study groups.

Table 2: Shows the plasm of liver "AST, ALT, ALP, and T. Bilirubin" plasma levels in male rabbits in the four group.

Experimental groups				
Parameter	*Control* Mean± SEM	*Panax ginseng* Mean± SEM	*$SnCl_2$* Mean± SEM	*P. ginseng +$SnCl_2$* Mean± SEM
AST(U/L)	112.5± 3.95[a]	154.7± 12.59[a]	130.0± 18.44[a]	119.2± 11.54[a]
ALT(U/L)	122.7± 7.58[a]	129.3± 9.77[a]	119.4± 4.52[a]	120.1± 3.39[a]
ALP(U/L)	327.3±6.90[a]	343.1±19.05[a]	215.8±5.46[b]	318.2±37.89[a]
T.Bilirubin (mg/dl)	0.6 ± 0.09[b]	1.5 ± 0.11[a]	0.4 ± 0.04[b]	0.5± 0.06[b]

To express values, mean ± SEM is utilized. Not all mean values in a row that did not share the superscript letters "a, b, and c" had significant differences "p < 0.05.".

http://www.doi.org/10.62341/smfa1423

Discussion

Important indicators of liver dysfunction include a group of soluble enzymes in the blood serum, including transaminases "AST and ALT," which are important in biological processes. Alanine transaminase "ALT" is found in large quantities in the liver and is therefore important in indicating diseases of this organ. The level of "ALT" in the serum increases when cellular degeneration or destruction occurs in the liver (Yousef *et al.,* 2007; Hassoun and Stohs, 1995). "AST and ALT" activity rose in the plasma of rabbits treated with $SnCl_2$ due to its leakage into the blood from the liver cytosol. (Yousef *et al.,* 2007; Navarro *et al.,* 1993). This was supported by a histopathologic study by El-Demerdash *et al.* (2005), which exposed significant alterations in liver cells in rabbits treated with $SnCl_2$, including mononuclear inflammatory infiltrate, the proliferation of the ductal epithelium, vasodilation, and congestion. It is anticipated that AST activity in the liver will increase in conjunction with liver necrosis-related disease; in this case, liver necrosis is associated with increased liver AST activity, which leads to its leakage from destroyed liver cells into the plasma (El-Demerdash *et al.*, 2005; Hassoun and Stohs, 1995). The findings of this investigation showed that the four study group's overall averages of "AST/GOT, ALT/GPT, ALP, GGT, and T. bilirubin" activities in serum were affected. A substantial decrease "$p < 0.05$" in "AST, ALT, GGT, and T. bilirubin" activity occurred at treatment with *P. ginseng* alone. However, the $SnCl_2$ treatment substantially "$p < 0.05$" increased "AST, ALT, GGT, and T. bilirubin" activity when compared to the control group. To achieve the control levels, *P. ginseng* and $SnCl_2$ were combined to lessen these effects. Regarding the overall means of "AST, ALT, ALP, and T. Bilirubin" activities in the plasma of the liver, "ALP and T. Bilirubin" activities increased substantially at *P. ginseng* therapy alone, while "AST and ALT" activities increased non-significantly "$p < 0.05$.". Comparing the $SnCl_2$ treatment to the control, however, revealed a non-significant rise in "AST and ALT" levels and a substantial drop in "ALP and T. Bilirubin" activities. To achieve the levels of the control, *P. ginseng* and $SnCl_2$ were combined to lessen these effects. Reduced "ALP" levels in the $SnCl_2$-treated group's plasma were similar to the results of El-Demerdash *et al.* (2005) & Yamaguchi *et al.* (1980, 1981). Yamaguchi *et al.* (1981) believed that a decrease in "acid and alkaline phosphatase" activity when

http://www.doi.org/10.62341/smfa1423

treating rats with $SnCl_2$ was an expression of the toxic action of inorganic tin. Furthermore, Rahman *et al.* (2000) postulated that the decrease in "AlP and AcP" activity in diverse body tissues of stressed animals was perhaps due to augmentation of cell membrane permeability and cell necrosis. In addition, the elevation in "AlP or AcP" activity in the blood is perhaps due to cell necrosis in the lungs, liver, and kidney. "ALP" level increased in the group that only got *P. ginseng* treatment. In addition, the elevation in "AlP or AcP" activity in the blood is perhaps due to cell necrosis in the lungs, liver, and kidney. "ALP" level increased in the group that only got P. ginseng treatment. Plasma "T. Bilirubin" activity was elevated in the $SnCl_2$ group in the study by Yousef *et al.* (2007). In contrast, observed a decrease in "T. Bilirubin" activity in the current investigation.

Conclusion

Both people and animals may suffer from liver atrophy and necrosis if their bodies contain excessive amounts of tin and its compounds. A dietary supplement called *P. ginseng* can improve hepatic cells by reducing ROS reactivity and increasing detoxifying enzyme activities, so preventing $SnCl_2$-induced liver diseases.

References

Aitio, A., Kiilunen, M., Santonen, T. and Nordberg, M. 2015, “Handbook on the Toxicology of Metals Gold and Gold Mining”.

Amacher, D. E. (1998). “Serum transaminase elevations as indicators of hepatic injury following the administration of drugs”. Regulatory toxicology and pharmacology, 27, 119-130.

Ang-Lee, M. K., Moss, J. and Yuan, C.-S. (2001). “Herbal medicines and perioperative care”. Journal of the American Medical Association, 286, 208-216.

Center, S. A. (2007). “Interpretation of liver enzymes”. Veterinary Clinics of North America: Small Animal Practice, 37, 297-333.

El-Demerdash, F. M., Yousef, M. I. and Zoheir, M. A. (2005). “Stannous chloride induces alterations in enzyme activities, lipid peroxidation and histopathology in male rabbit: Antioxidant role of vitamin C”. Food and Chemical Toxicology, 43, 1743–1752.

http://www.doi.org/10.62341/smfa1423

Harper, C. (2005). "Toxicological profile for tin and tin compounds". Agency for Toxic Substances and Disease Registry.

Hassoun, E.A. and Stohs, S.J. (1995). "Comparative studies on oxidative stress as a mechanism for the fetotoxic of TCDD, endrin and lindane in C57BL/6J and DBA/2J mice". Teratology, 51, 186–192.

Hofseth, L. J. and Wargovich, M. J. (2007). "Inflammation, cancer, and targets of ginseng". The Journal of nutrition, 137, 183S-185S.

Howe, P. and Watts, P. (2005). "Tin and inorganic tin compounds". World health organization.

Inoue, M., Wu, C., Dou, D., Chen, Y. and Ogihara, Y. (1999). "Lipoprotein lipase activation by red ginseng saponins in hyperlipidemia model animals". Phytomedicine, 6, 257-265.

Johnson, M. A. and Greger, J. (1982). "Effects of dietary tin on tin and calcium metabolism of adult males". The American journal of clinical nutrition, 35, 655-660.

Kam, P. and Liew, S. (2002). "Traditional Chinese herbal medicine and anaesthesia". Anaesthesia, 57, 1083-1089.

Kim, H. G., Yoo, S. R., Park, H. J., Lee, N-H., Shin, J-W., Sathyanath, R., Cho, J-H. and Son, C-G. (2011). "Antioxidant effects of Panax ginseng C.A. Meyer in healthy subjects: a randomized, placebo-controlled clinical trial". Food and Chemical Toxicology, 49 (9), 2229–2235.

Kitts, D. D., Wijewickreme, A. N. and Hu, C. (2000). "Antioxidant properties of a North American ginseng extract". Molecular and cellular biochemistry, 203, 1-10.

Navarro, C.M., Montilla, P.M., Martin, A., Jimenez, J. and Utrilla, P.M. (1993). "Free radicals scavenger and antihepatotoxic activity of Rosmarinus". Plant Medicin, 59, 312–314.

Paulson, D. (2008). "Biostatistics and microbiology: a survival manual". USA, Springer Science & Business Media.

Raghubanshi, A., Alam, M. T., Bari, B., Sehar, N., Siddiqi, Z. H., Khatoon, A., Idris, M., Khan, M. N. and Akhtar, J. (2024). "Qalaee (Stannum) metallic origin element, its chemical compounds, action, therapeutic uses, adverse effect and pharmacological activity studies: A Review". Journal of Drug Delivery and Therapeutics, 14(7), 136-141.

Rahman, M.F., Siddiqui, M.K. and Jamil, K. (2000). "Acid and alkaline phosphatase activities in a novel phosphorothionate

http://www.doi.org/10.62341/smfa1423

(RPR-11) treated male and female rats. Evidence of dose and time dependent response". Drug Chemistry and Toxicology, 23, 497–509.

Reicks, M. and Rader, J. I. (1990). "Effects of dietary tin and copper on rat hepatocellular antioxidant protection". Proceedings of the Society for Experimental Biology and Medicine, 195, 123-128.

Tung, N. H., Uto, T., Morinaga, O., Kim, Y. H. and Shoyama, Y. (2012). "Pharmacological Effects of Ginseng on Liver Functions and Diseases: A Minireview". Evidence-Based Complementary and Alternative Medicine, 2012, 7.

Yamaguchi, M., Saito, R. and Okada, S. (1980). "Dose-effect of inorganic tin on biochemical indices in rats". Toxicology, 16, 267–273.

Yamaguchi, M., Sugii, K. and Okada, S. (1981). "Changes in mineral composition and its related enzyme activity in the femur of rats orally administered stannous chloride". Journal of Pharmacobiodynamics, 4, 874–878.

Yousef, M., Awad, T., Elhag, F. and Khaled, F. (2007). "Study of the protective effect of ascorbic acid against the toxicity of stannous chloride on oxidative damage, antioxidant enzymes and biochemical parameters in rabbits". Toxicology, 235, 194-202.