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Original article

Ginseng Panax and Its Impact on Mitigating the Negative Effects of Tin Chloride on Kidney Function and Serum Proteins in Male Rabbits

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Abstract
The existing investigation aimed to locate *ginseng*'s ability to resist the harmful effects of tin chloride "$SnCl_2$" on the kidneys and serum proteins. Male rabbits were used in this investigation. The number of study groups was 4, each containing 5 rabbits, so the total number of rabbits used was 20. For twelve weeks, the animals underwent oral therapy per day. The experiment was designed as follows: The "Control group" (group 1) rabbits were given corn oil only. "*Ginseng* group" (group 2) rabbits were treated only with "100 mg/kg body weight" of *ginseng*. "Tin chloride ($SnCl_2$) group" (group 3) rabbits were treated with "20 mg/kg body weight" of $SnCl_2$ only. Finally, the "*Ginseng* + $SnCl_2$ group" (group 4) rabbits were treated with $SnCl_2$ and *ginseng* together. The outcomes displayed a substantial rise in the "*Ginseng* group" rabbit in the following serum parameters: "total protein (TP), albumin (A), and globulin (G)". A substantial "$P<0.05$" decrease of the "urea and creatinine." The exact opposite occurred in the "$SnCl_2$ group", where serum proteins "TP, A, and G" decreased substantially, and "urea and creatinine" levels increased markedly. *Ginseng* minimizes the harmful effects of $SnCl_2$ on all tested parameters, and this was demonstrated in the "*Ginseng* + $SnCl_2$ group". In conclusion, *Panax ginseng* has an important role in reducing the harmful effects of $SnCl_2$.
Keywords: Male Rabbit Kidney, Tin Chloride, *Panax Ginseng*, Urea, Creatinine.

Introduction

"Tin (Sn)" is a heavy metal found in the crust of the earth. Its average concentration is about 2 milligrams per kilogram [1]. Tin is widely used in our daily lives, in lining beverage and food cans, in container plating, and in alloys such as pewter and bronze. In the manufacture of rodenticides and insecticides, plastic pipes, and paints [1]. Inorganic components of tin, such as "tin oxide, tin chloride, and tin sulfide," are formed by the interaction of tin with oxygen, chlorine, and sulfur. Tin is also utilized in the manufacture of colors, perfumes, toothpaste, and soap. Organic tin compounds, "triphenyltin, tributyltin, and dibutyltin," are formed when tin interacts with carbon. Organic forms of tin are not found in the environment but are often synthetic materials [1]. Inorganic tin is present in the bones and other parts of the body, including the skin, kidneys, lymph nodes, tongue, lungs, liver, and spleen. Nephrotoxicity, neurotoxicity, genotoxicity, low calcium in bone, and immunotoxicity are among the serious effects of inorganic tin on the body [2,3]. Excess tin can cause anemia, in addition to the risks posed by tin on the kidneys [4].
Stannous ions are poisonous, and it seems that this toxicity is mediated by the formation of "reactive oxygen species (ROS)". Rabbit's kidneys are damaged by prolonged exposure to tin chloride [5]. To appreciate kidney function, serum "urea, and creatinine are used as biomarkers. Creatinine phosphate metabolism in muscles produces creatinine, whereas the liver generates "urea" from amino acids [6]. Rising "urea and creatinine" are kidney damage indicators. The kidney's filtration system deteriorates as kidney cells collapse, leading to elevated "urea and creatinine" levels [7]. "Urea and creatinine" parameters are used to estimate the results [8]. The usage of herbs and their products is widely spread due to their perceived efficacy and lack of negative effects [9]. Among these herbs, *P. ginseng* has a lengthy history and is today one of the most widely used medicinal plants in the world [10]. *Ginseng*'s pharmacological effects are mainly caused by its saponins, also known as ginsenosides, the plant's principal and bioactive components [11]. Most of the actions of *ginseng*, such as its anti-inflammatory, anti-cancer, antioxidant, and vasorelaxation qualities, seem to be attributed to its saponins [12]. According to [13], ginseng boosts the antioxidant defense system [14], stating that *ginseng* properties are anticipated to supply several useful effects against organ damage. To determine whether *P. ginseng* could reduce the negative effects of tin chloride ($SnCl_2$) on the kidney function parameters and serum protein concentrations of male rabbits, the current investigation was conducted.

Methods

Chemicals

Tin chloride "$SnCl_2$" (1 mg/L) was obtained from the Chemistry Department of the Faculty of Science. *Panax ginseng* powder was obtained from a local pharmacy, where 7 grams were dissolved in 42 ml of normal saline.

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Animal Management

20 male rabbits were used, weighing 1.641 ± 27.2 kg and 6 months old. Water and food were available ad libitum throughout the three-month experiment. Every animal was housed in a different cage and weighed once a week.

Experiment Design

The experiment included 4 equal-sized groups of rabbits, each containing 5 rabbits; the "first group" served as a "control group," where rabbits were given only one milliliter of corn oil for three months, twice a week, via oral gavage. In the "second group," the rabbits were given *Panax ginseng* alone at an oral dose of 0.01 g/kg [15]. The "third group" also received orally 20 mg/kg/day of $SnCl_2$ alone. The "fourth group" received a mixture of *ginseng* + $SnCl_2$ orally.

Biochemical tests and enzyme activity

After being drawn, after "20 min" at "25°C", the blood clotted in a plain tube. All of the following were classified as either normal or negative. A refractometer was used to measure specific gravity. On the day of sample collection, all results were noted as either positive or negative and compared to the medical record. By centrifugation at "860×g" for "20 min," extract the serum, which in turn was kept until needed at "-20°C." Kidney function parameters were estimated using an automated analyzer and a kit approach.

Statistical analysis

Conducted a data analysis using "Graph Prism Pad and Minitab version 17" and used "ANOVA analysis and Tukey multiple comparison tests" to locate statistically significant differences. Which was estimated to be "P < 0.05" [16].

Results

The mean values of serum "total protein (TP), albumin (A), and globulin (G)" are observed in "Table 1 and Figures 1-3." When administered *P. ginseng* alone, "TP, A, and G" levels increased substantially. However, in the $SnCl_2$-administered group, the opposite occurred; "TP, A, and G" levels were lower than in the control group. *Ginseng* mitigated the effects of $SnCl_2$ in the *ginseng* + $SnCl_2$ group, as the measured parameters were close to those in the control group.

In "Table 2 and Figures 4 and 5", it was observed that the mean values of "urea and creatinine" in male rabbits were lower for "the *ginseng* group" when contrasted to "the control group," and the opposite was observed in "the $SnCl_2$ group," where levels of "urea and creatinine" were substantially higher contrasted to "the control group. In "the *ginseng* + $SnCl_2$ group," levels of both "urea and creatinine" were close to those "the control group," due to the role played by *ginseng* in reducing the harmful effects of $SnCl_2$.

Table 1. States values of serum "total protein, albumin, and globulin" of rabbit males in all remedied groups

	Experimental groups			
Parameter	**Control Mean± SEM**	***Ginseng* Mean± SEM**	**$SnCl_2$ Mean± SEM**	***Ginseng* +$SnCl_2$ Mean± SEM**
Globulin (U/L)	2.82±0.126^{a}	2.48± 0.162^{a}	2.81±0.154^{a}	2.80± 0.099^{a}
Albumin (U/L)	3.92±0.060^{b}	4.43±0.088^{a}	3.56±0.109^{b}	3.99±0.076^{b}
T. Protein (U/L)	6.74 ± 0.104^{ab}	6.91 ± 0.121^{a}	6.36 ± 0.128^{b}	6.79 ± 0.091a^{b}

Each treatment group has n = 5; values are presented as means ± SEM. Different "superscript letters a, b, and c" within columns differed substantially ("p<0.05").

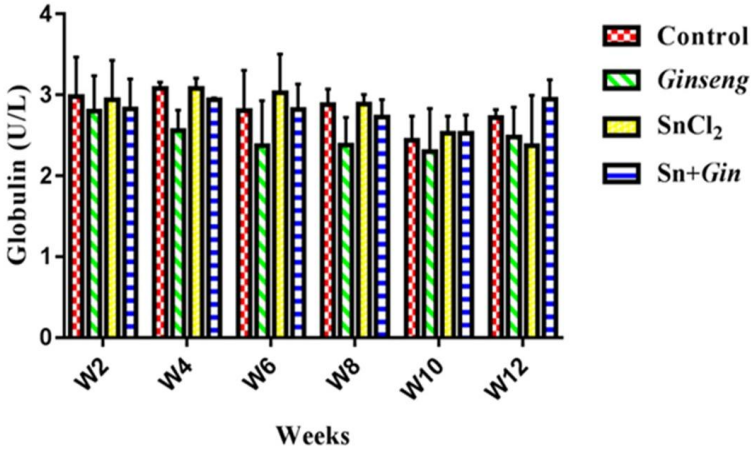

Figure 1. "Globulin Values (mean± SEM)" every two weeks of rabbit males in all study groups.

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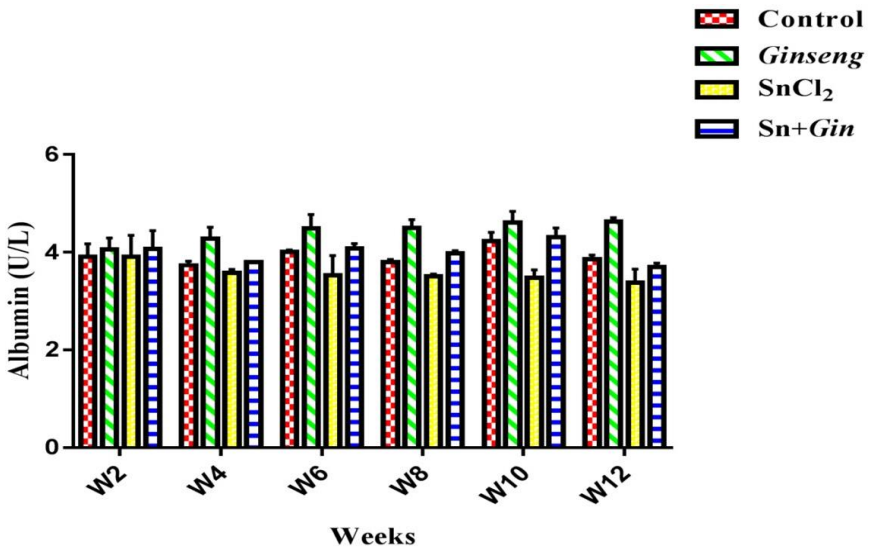

Figure 2. "Albumin values (mean± SEM)" every two weeks of rabbit males in all study groups.

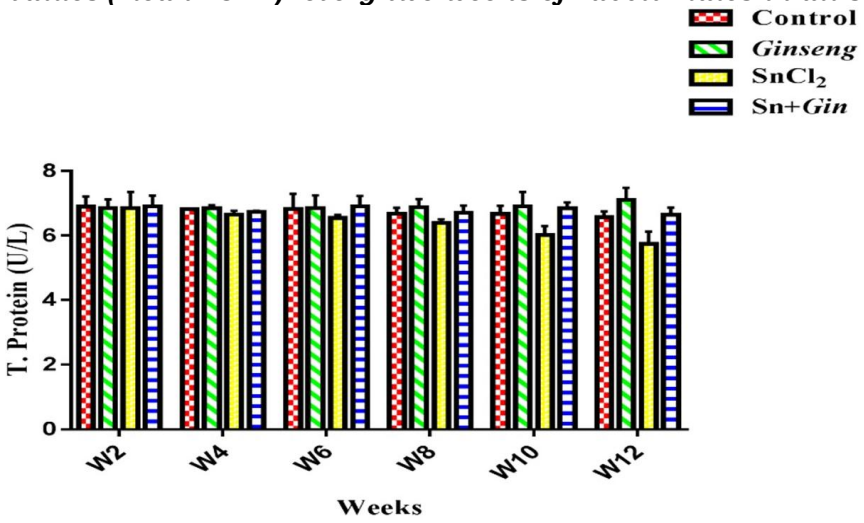

Figure 3. "Total protein values (mean± SEM)" every two weeks in rabbit males in all study groups.

Table 2. States values of "urea and creatinine" of rabbit males in all remedied groups.

Parameter	Experimental groups			
	Control Mean± SEM	**Ginseng Mean± SEM**	**$SnCl_2$ Mean± SEM**	**Ginseng +$SnCl_2$ Mean± SEM**
Urea (mg/dl)	38.50±0.512^b	35.82±1.075^b	46.98±1.816^a	39.19±1.102^b
Creatinine (g/dl)	0.76± 0.042^b	0.59±0.021^b	1.20±0.084^a	0.76±0.042^b

Each treatment group has n = 5; values are presented as means ± SEM. Different "superscript letters a, b, and c" within columns differed substantially ("p<0.05").

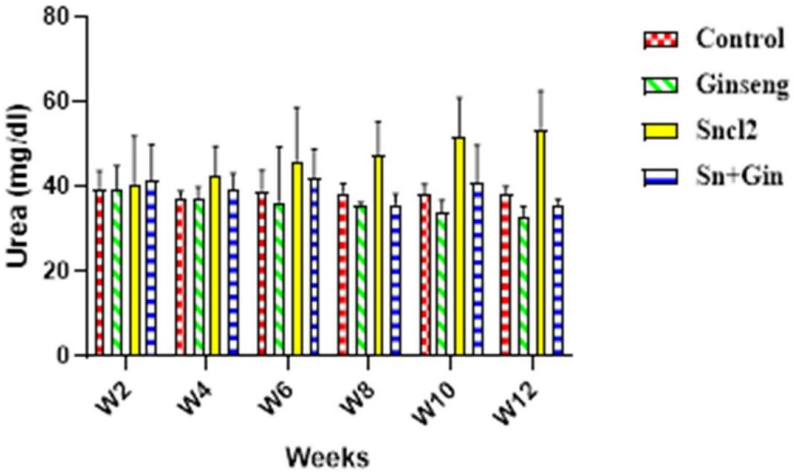

Figure 4. "Urea values (mean± SEM)" every two weeks of rabbit males in all study groups.

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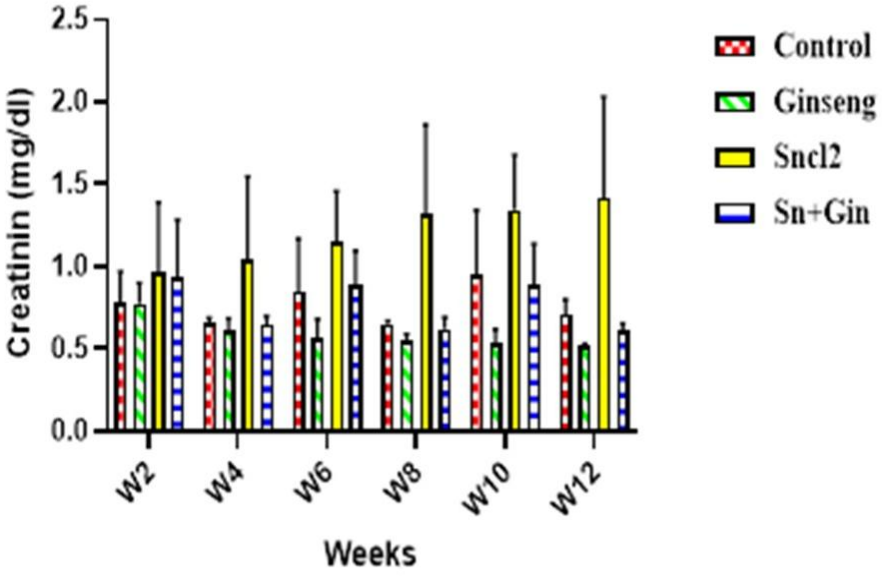

Figure 5. "Creatinine values (mean± SEM)" every two weeks of rabbit males in all study groups.

Discussion

In the current investigation, it was found that when male rabbits were given only ginseng, levels of the "total protein, albumin, and globulin" in serum increased, whereas levels of these parameters decreased when the rabbits were treated with $SnCl_2$ compared to "the control group". This concurs with what [17] found. Levels of "total protein, albumin, and globulin" were adjacent to values of "the control group" in the group administered with *ginseng* + $SnCl_2$.

The decrease in plasma "total protein" from $SnCl_2$ treatment was primarily due to lower "albumin and globulin" levels. For animals exposed to a polluted environment, low plasma proteins are due to changes in the liver's generation of free amino acids and proteins, or changes in how these substances are metabolized [17,18]. [17,19] found that when male rabbits were given only *ginseng*, the major cause of decreased blood protein was also been attributed to the loss of too much due to nephrosis. It might also arise from "reduced protein synthesis, increased proteolytic activity, or degradation". Liver cells may be damaged by $SnCl_2$, which partially leads to a significant decrease in blood proteins.

Regarding kidney function, "urea and creatinine" levels decreased in male rabbits administered with *ginseng* alone. Conversely, a substantial increase in "urea and creatinine" levels was observed when rabbits were given $SnCl_2$. *Ginseng* reduced the harmful effects of $SnCl_2$ in the group receiving both *ginseng* and $SnCl_2$, bringing them close to control values.

If the renal tubules are damaged or the pressure or volume of blood flowing through them decreases, as in nephritis, the renal tubules lose their ability to rid the blood of "urea" and other waste products, and the level of "urea" in the blood increases. Therefore, high blood "urea" levels are considered one of the most important indexes of impaired kidney function in rabbits administered with $SnCl_2$ [17,20]. According to [21], Bowman's capsule and the cells lining the renal convoluted tubules were changed by $SnCl_2$. Failure of the liver and the drop in proteins of the plasma support the idea that protein breakdown produces urea. As a result of the liver and its functions being affected by $SnCl_2$, increased urea concentrations occur in the plasma of animals given $SnCl_2$.

Conclusion

The harm to the kidneys, the swelling of the renal tubular epithelium, and the proximal tubule degeneration represent harmful effects of increasing the concentration of tin compounds in the human body and the animal, and ginseng can be used as a dietary supplement to improve them.

Conflicts of Interest

The authors declared no conflict of interest.

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المستخلص

هدفت الدراسة الحالية إلى تحديد قدرة الجينسنغ على مقاومة الآثار الضارة لكلوريد القصدير "$SnCl_2$" على الكلى وبروتينات المصل. استخدمت ذكور الأرانب في هذه الدراسة. بلغ عدد مجموعات الدراسة 4 مجموعات، تضم كل منها 5 أرانب، أي ما مجموعه 20 أرنبا. خضعت الحيوانات للعلاج عن طريق الفم يوميًا لمدة اثني عشر أسبوعا. صُممت التجربة على النحو التالي: أعطيت أرانب "المجموعة الضابطة" (المجموعة 1) زيت الذرة فقط. عولجت أرانب "مجموعة الجينسنغ" (المجموعة 2) بجرعة "100 ملغم/كغم من وزن الجسم" فقط من الجينسنغ. عولجت أرانب "مجموعة كلوريد القصدير "($SnCl_2$)(المجموعة 3) بجرعة "20 ملغم/كغم من وزن الجسم" فقط من كلوريد القصدير. وأخيرًا، عولجت أرانب "مجموعة الجينسنغ + $SnCl_2$" (المجموعة 4) بالجينسنغ وكلوريد القصدير معا. أظهرت النتائج ارتفاعًا ملحوظًا لدى أرنب "مجموعة الجينسنغ" في معايير المصل التالية: "البروتين الكلي(TP) ، والألبومين(A) ، والغلوبيولين .(G)" كما انخفض مستوى "اليوريا والكرياتينين" بشكل ملحوظ "$P<0.05$" .أما في "مجموعة "$SnCl_2$"، فقد انخفضت مستويات بروتينات المصل " TP ، A، و G" بشكل ملحوظ، بينما ارتفعت مستويات "اليوريا والكرياتينين" بشكل ملحوظ. يقلل الجينسنغ من الآثار الضارة لـ $SnCl_2$ على جميع المعايير المختبرة، وقد ثبت ذلك في "مجموعة الجينسنغ $SnCl_2$ + ."وفي الختام، يؤكد دور الجينسنغ باناكس في الحد من الآثار الضارة لـ $SnCl_2$.

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