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Full length article

Activity of *Panax ginseng* on hematological and biochemical parameters of healthy rabbits

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ABSTRACT

The study was carried at Faculty of Agriculture and Veterinary Medicine, Thamar University, Dhamar, during the period from May to July 2013 with main objective to investigate the effects of P. ginseng on hematological and biochemical parameters in local rabbits. A total of 49 adult female rabbits were selected and subjected for experiment. The rabbirs were randomly located into seven groups. 1st, 2nd and 3rd groups were received daily oral doses of P. ginseng root powder at concentration of 1g , 3g and 5g / body weight respectively and 4th, 5th and 6th groups were received daily overall doses P. ginseng capsules at concentration of 0.2g, 0.6g and 1g/Kg respectively. The 7th group distilled water and acted as control group. Blood samples were collected from rabbits for hematological and biochemical analyses using standard techniques. The results revealed significant (P>0.05) an increase in hemoglobin blood in 2nd and 4th groups with mean values as (31.53± 0.45) and (32.00±4.50) respectively compared to the control group (16.03± 1.45). But, the results itself revealed that P. ginseng did not cause a significant (P<0.05) change in the total number of white blood cells (WBCs) in the experimental animal groups. Moreover, the results demonstrated that a significant (P<0.05) decreases in levels of in enzyme liver (AST, ALT, and ALP) and markers of kidney i.e., Urea and creatinine. In conclusion, the ginseng crud powder and capsules at different doses has biological effect on the hematological and biochemical parameters, thus justify its use in traditional and alternative medicine. Further studies are recommended to study toxicity of ginseng.

Keywords: Activity, Ginseng, hematological and biochemical parameters, Rabbit, Root

INTRODUCTION

Medicinal plants have been used since antiquity to combat diseases and are an important source of modern drugs. The use of plants for their therapeutic properties is an ancient tradition, preceding modern medicine, pharmacology, and

chemistry (Simonová et al., 2025). Today, many drugs are derived from plants, and they remain crucial in healthcare systems worldwide, particularly in traditional medicine, which is often the primary healthcare system in many developing societies (Majid, 2019; El-Saadony et al., 2025) .

Ginseng (Panax ginseng Meyer) is a perennial plant of the Araliaceae family that grows in shaded and humid areas of Asian countries particularly in China and Korea. It has been used as an herbal remedy in ancient China, Korea, Japan and the Far East for more than 5,000 years and the medical efficacy of ginseng was documented in ancient Asian literatures (Attele et al. 1999; Bucci 2000). But, American ginseng (Panax quinquefolium L.), a plant native to North America, is now also cultivated and used in many countries (Abdel- Fattah et al., 2010; Gao et al., 2025). Several researches have well documented that ginseng contains saponins, antioxidants, peptides, polysaccharides, alkaloids, phenols and vitamins B1 and B2, lignin etc. Among these, saponins (ginsenoside) are considered to be the principal bioactive ingredients (Qi et al., 2011; Lakshmi et al., 2011; Kim, 2018 ;; Majid, 2019; He et al., 2025). Saponins are believed to boost the immune system and to provide pharmaceutical and antioxidant benefits to humans and animals. These positive properties could be explored for better rabbit productivity (Amaefule et al., 2019).

Several investigations have been carried out on ginseng and strongly support the evidence that ginseng Possesses a wide range of pharmacological and physiological activities, including antiaging, immunoenhancement, antistress, anti-fatigue, and anti-tumor action anti-inflammatory activity, improvement of physical stamina, and stimulation of the appetite, and also thought to has effects on learning, memory and behavior (Liu and Xiao 1992; Sun 2004). In study carried by Gadkarem et al. (2010). They reported that the ginseng has significant effects on the RBC and hemoglobin(Hb)count (Sotaniemi, et al. 1995; Salim et al. 1997; Sun 2004; Simsek et al. 2007; Waugh & Grant 2010; Iwuji et al. 2018; Amaefule et al. 2019). Panax ginseng increased leukocyte activity (Hu et al. 1995) and numbers of total leukocytes (WBC), lymphocytes and alveolar macrophages (Engels and Wirth 1997; Scaglione et al. 2001; Muller et al. 2011; Iwuji et al. 2018). Panax ginseng increase plasma levels of total protein (TP), albumin (A), globulin (G), while decrease bilirubin , urea, creatinine and glucose in serum body (Iwuji et al. 2018; Omar et al. 2021; Hamed et Al. 2025). Treatment with ginseng caused decrease in concentrations of plasma alanine amino transferase (ALT), aspartate amino transaminase (AST), alkaline phosphatase (ALP) activities (Tavares et al. 2004; Silva et al. 2005; Elmas et al. 2006; Melillo 2007; Jenkins 2008; Muller et al. 2011; Nguyen et al. 2012; Iwuji et al. 2018; Al-Dhufairi & Al-Mahdawi 2020; Omar et al. 2021). Therefore, the present study was designed to investigate the effect of ginseng on hematological and biochemical parameters of local rabbits.

MATERIALS AND METHODS

Study sitting

The study was carried on experimental farm, at the Faculty of Agriculture and Veterinary Medicine, Thamar University, Dhamar during the period from May to July, 2013.

Experimental Animals

A total of 49 adult female rabbits of local breed, 9–12-month-old and weighting 1700 -1200 g were purchased from Al-Raboa market (animal market). The rabbits were bought to experimental farm at the Faculty of Agriculture and Veterinary Medicine, Thamar University. The rabbits were kept in door and allowed them to acclimatize for 1 week before the beginning of the experiment. All rabbits were fed with same ration green fodder, wheat grains and access to fresh water ad libitum. The animals were housed in constant temperature and relative humidity. The study's experimental protocol adheres to the National Committee for Research Ethics in Science and Technology's ethical guidelines for the use of animals in research (Mikkelsen et al., 2017).

Plant Materials

The dry roots of Panax ginseng (Red Korean Ginseng, RKG), were purchased from local market (Yassin Atara store) Sana'a, Yemen. Ginseng capsules were obtained from pharcophmmletid, (Patch No. 155, Egypt). The roots were identified and authenticated by the Botanical expert, Faculty of Agriculture, Thamar University. The roots were powdered using a commercial blender. The powder was packaged and kept at retrigger till used.

Experimental design

After acclimation period, the experimental rabbits were randomly divided into seven groups, each group contained 7 animals 1st, 2nd and 3rd groups received Panax ginseng powder daily orally at doses of 1g, 3g and 5g body weight respectively, whereas 4th,5th and 6th groups received daily Korean Panax ginseng capsules orally at the doses of 0.2 g, 0.6g and 1g body weigh respectively. The 7th group received distal water and acted as control group. The experiment was terminated after one month. The hematological and biochemical parameters were measured at the being of experimental and daily up to termination of experimental.

Collection of blood samples

Blood samples were collected daily from experimental animals for hematological and biochemical analyses. Blood samples were collected according to Archetti et al. (2008), in brief, A total of 5 ml blood sample directly were collected from cardiac puncture of immobilized animals. This was done very quickly in order to limit the effect of acute stress on blood parameters. A 22- gauge sterile needle was used in all categories, except in 30-45 days old rabbits, where a 26-gauge needle was used. Half of the sample was expelled gradually into graduated tubes containing K3-EDTA (Ethylene diamine tetra-acetic acid); then, tubes were immediately capped and mixed gently by repeated inversion. The rest of the sample was collected in sterile tubes without anticoagulant. All blood samples were transported to the laboratory at +4°C within 3 hours. Serum was separated and frozen at -20°C for biochemical analyses. Hematological analyses on EDTA samples were analyzed on the day of collection.

Hematological assay

Hematological parameters were analyzed by automatic whole blood analysis (Abbott Diagnostic Division, Sonta ClavaCa) according to the instructor of manufacture. The hematological parameters analyzed were hemoglobin (Hb), white blood cells (WBC) and differential cell counts (lymphocyte, neutrophil, monocytes and eosinophil). Briefly, 5 ml of Drapkin solution was added to the plastic tube and 20ul were added to whole blood and leave it for 10 minutes in order to be the decomposition of red blood cells. The device was set at wavelength 54 nm. The device was filtered the hemoglobin solution and then the sample was read by the HB device the reading formula as follow: Reading sample * = 36.6 g / dl (100) ml.

Biochemical assay

Sera were used for determination of biochemical parameters, at 37 °C in a random-access clinical analyzer (SYNCRON CX5-DELTA, Beckman Coulter, Fullerton, U.S.A.) using kits by the same firm. The parameters and the respective methods applied are the following: Aspartate Amino Transferase (AST) - Henry method; creatine kinase (CK) - Rosalki method; Alanine Amino Transferase (ALT) - Henry method; lactate dehydrogenase (LDH) - pyruvate to lactate method; creatinine - colorimetric, Jaffè method; urea - enzymatic colorimetric, urease method; (method. Serum lysozyme, a parameter of non-specific immunity, was investigated according to an established procedure (Amadori et al., 1997).

Statistical analysis

All the measurements were presented as mean ± S.E and statistical significance among the group was analyzed by analysis of variance (ANOVA) following LSD test at P≤0.05 using SPSS® version 14.0 program (Chicago, USA).

RESULTS &DISCUSSION

Hematological and biochemical parameters in human and animals can be affected by many factors such as diet, environmental conditions, disease status, housing density and exposure to environmental pollutants (Aviram and Dornfeld,2001). Numerous plant-based materials are widely being researched for their use in animal/rabbit production, of which ginseng is one of them. Ginseng, especially the genus, Panax, has been extensively described and documented (De Jong et al., 2005); and its biological activities in both human and animal models have been widely reviewed (Iwuji, 2016). Some of the reported biological activities of Panax ginseng include antioxidant properties, immune function, aphrodisiac properties, endocrine effect, protein synthesis, hematological and hepato-protective effect (Sandroni, 2001; Oremosu et al., 2013; Leung & Wong, 2013; Iwuji et al., 2017). This study was carried out in local rabbits with main objective to evaluate the activity of *P. ginseng* on hematological and biochemicals parameters.

The effect of *P. ginseng* on hematological parameters are presented in Table 1. As shown, the

results revealed that significant (P>0.05) increase in hemoglobin blood, but the results itself revealed that ginseng did not cause a significant (P<0.05) change in the total number of white blood cells (WBCs) counts in the experimental animal groups compared to the control group. The higher mean value of hemoglobin (Hb) was recorded in 1st group (34.46±.25) of experimental animals; whereas, the lower mean value in 6th group (14.53±1.65) compared to control group (16.03±1.45). The higher mean value of WBCs was recorded in 4th group (5.70±1.20); whereas the lower mean value in 3rd group (3.03±.65) compared to control group (4.70±2.50). These results are in agreement with findings of Ibrahim et al; 2021; ELnaggar et al, 2022; who studies the effect of ginseng in rats, Japanese Quail respectively. However, it`s in contrary with findings of Abou El-Gheit et al., 2011; Amaefule et al., 2019; Khaled et al., 2022 who studies the effect of ginseng in rabbits and lambs respectively.

Considering the counts of lymphocyte, neutrophil, Monocytes and eosinophils, the results showed that, higher mean value of lymphocyte counts was recorded in 3rd group (68.66±16.01); whereas, the lower mean value in 6th group (57.00±3.00) and 5th groups (57.33±2.02) compared to control group (52.00±7.50). The higher mean value of the neutrophil was recorded in group 6th (36.33±2.51); whereas, the lower mean value in 3rd group (25.00±8.66) compared to control group (25.33±7.79). The higher of mean value of the Monocytes was recorded in 4thgroup (9.00±3.46); whereas, lower values in 3rd groups (1.50±0.28) compared to control group (5.00±.00). The effect of P. ginseng on the eosinophils was also investigated in current study and the higher mean value of eosinophils was recorded in 1st group (7.50±0.28); whereas, the lower mean value in 2nd group compared to control group1.50±0.28). Statistically, there were no significant differences observed (P>0.05) in mean values among treatment and control groups of the rabbits (Table 1). These results are in contrary with findings of (Hu et al. 1995; Engels and Wirth 1997; Scaglione, et al. 2001; Muller et al. 2011; Iwuji et al. 2018) who reported that *P.ginseng* increase the activity of leukocytes and lymphocytes.The improvement in hematological parameters in experimental animals caused by ginseng may be attributed to strong anti-oxidant effect of ginseng which prevent the destruction of RBCs from free radical formation and enhance hematopoietic process in bone marrow. However, the contrast between the current results and previous findings may due to animals' species, status condition of animals, doses concentrations used, immune factors.

AST, ALT, and ALP are considered to be the markers of organ disfunction, indicator of cellular damage, cell leakage and the loss of cell membrane integrity in the liver, kidney, heart and other organs(Uluısık & Keskin, 2016). The present investigation indicated that administration of *P. ginseng* in female rabbits displayed decease significantly (P<0.05) in enzymes liver activities such as aspartate amino transaminase (AST) and alkaline phosphatase (ALP) in treated groups compared to control groups; while none with alanine amino transferase (ALT), as presented in Table 2. These results are in parallel with findings reported previous studies in rabbits and other animals (Tavares et al. 2004; Silva et al. 2005; Elmas et al. 2006; Melillo, 2007; Jenkins 2008; Muller et al. 2011; Nguyen et al. 2012; Iwuji et al. 2018; Al-Dhufairi & Al-Mahdawi 2020; Omar et al. 2021). The decrease of liver enzymes levels in rabbits in this study may be attributed to the protective effects of ginseng on kidney and liver damage (Uluısık & Keskin; 2016). In addition, it has been reported that ginsenosides are responsible for its hepatoprotective effect by destroy lipid peroxyl radicals and reactive oxygen species (Liu et al., 2010; Uluısık & Keskin; 2016).

Serum urea and creatinine levels are widely used as markers for renal function screening as they are the most sensitive parameters in diagnosis of renal disease (Ferguson and Waikar, 2012). Similarly, the results of this study revealed that *P. ginseng* effect was non-significant (P<0.05) on mean values of kidney makers i.e urea and creatinine levels of treated groups compared to the control (Table 2). These results are disagreed with findings reported by (Iwuji et al. 2018; Omar et al. 2021; Hamed et Al., 2025) who cited that ginseng reduced the activity of urea and creatinine serum of animals including rabbits. The lower levels of urea and creatinine serum in rabbits recorded in current study may due *P. ginseng* minimize renal injury by inhibiting oxidative stress, inflammatory responses, epithelial-mesenchymal transition, and fibrosis(Xu et al., 2020; Zhu et al., 2020; . Omar et al., 2022).

Table 1: Effect of *Panax ginseng* on hematological values of rabbits (Mean ±SD)

TG	Hb	WBCs	Lymphocyte	Neutrophil	Monocyte	Eosinophil
1st	34.46±0.14^{a}	3.65±0.14^{a}	62.66±4.91^{a}	25.33±6.06^{a}	5.00±1.73^{a,b}	7.50±0.28^{a}
2nd	31.53±0.26^{a,b}	3.65±0.31^{a}	62.33±6.64^{a}	30.00±5.77^{a}	3.83±0.16^{a,b}	3.50±0.86^{a,b}
3rd	24.00±5.13^{b,c,d}	3.03±0.37^{a}	68.66±9.24^{a}	25.00±8.66^{a}	1.50±0.28^{b}	4.50±0.28^{a,b}
4th	32.00±2.59^{a,b}	5.70±0.69^{a}	59.33±1.45^{a}	27.50±1.44^{a}	9.00±3.46^{a}	4.00±0.57^{a,b}
5th	14.53±5.51^{a,b,c}	4.35±1.58^{a}	57.33±2.02^{a}	33.00±1.15^{a}	4.00±1.1^{a,b}	5.50±2.02^{a,b}
6th	16.03±0.95^{d}	3.53±0.95^{a}	57.00±1.73^{a}	36.33±1.45^{a}	6.33±0.86^{b}	4.00±2.30^{a,b}
Control	16.03±0.83^{c,d}	4.70±1.44^{a}	52.00±7.50^{a}	25.33±7.79^{a}	5.00±.00^{a,b}	1.50±0.28^{b}

GT: Treatment groups, Hb=hemaglobin, WBC=white blood cells. Means within the same column carrying different superscript letters are significant at P < 0.05.

Table 2: Effect of *Panax ginseng* on biochemical values of blood in rabbits (Mean ±SD)

TG	**ALT**(u/l)	**AST**(u/l)	**ALP**(u/l)	**Urea**(mg/dl)	**Creatinine**(mg/dl)
1st	30.00±0.58^{a,b}	22.33±0.88^{b,c}	63.33±6.92^{c,d}	8.65± 0.32^{b}	30±0.12^{a,b}
2nd	29.43±3.17^{a,b}	23.50±3.18^{b,c}	75.00±0.00^{b,c,d}	7.80± 0.40^{b}	60±0.17^{a}
3rd	33.00±1.15^{a,b}	16.50±2.510^{c}	90.00±2.89^{a,b,c}	7.73± 0.72^{b}	65±0.20^{a}
4th	27.50±2.023^{a,b}	23.00±2.89^{b,c}	74.50± 2.02^{b,c,d}	11.95± 0.38^{a}	75±0.03^{a}
5th	26.33±6.06^{b}	33.00±1.15^{a,b}	106.00±2.89^{a,b}	7.90±0.46^{b}	10± 0.00^{b}
6th	40.00±0.58^{a}	31.00±2.31^{a,b}	55.00±17.32^{d}	8.86±0.18^{b}	40± 0.06^{a,b}
Control	38.00±7.50^{a,b}	37.00±6.92^{a}	116.33±10.68^{a}	7.70±0.35^{b}	43.0±0.20a^{,b}

GT: Treatment groups, ALT=alanine aminotransferase, AST= aspartate aminotransferase, ALP=alkaline phosphatase. Means within the same column carrying different superscript letters are significant at P < 0.05

CONCLUSION

The *P. ginseng* crud powder at different doses have biological effect on the hematological and biochemical parameters, thus justify its use in traditional and alternative medicine.

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CONTRIBUTION OF AUTHORS

All authors contributed to the study conception, design, data collection, analysis and written 1st draft and final version of the manuscript. All authors read and approved the final version of manuscript.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest associated with this manuscript.

ETHICS STATEMENT

The study protocol was approved by the faculty board of the Faculty of Veterinary Medicine, Thamar University.

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تأثير نبات الجنسينج على بعض القيم الدموية والكيمياء حيوية في الأرانب

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الملخص

اجريت هذه الدراسة في كلية الزراعة والطب البيطري، جامعة ذمار خلال الفترة من شهر مايو الى يوليو من عام 2013 م بهدف التعرف على تأثير نبات الجنسينج على بعض القيم الدموية والكيميائية الحيوية في اناث الارانب. تم اختيار ما مجموعه 49 ارنب للإجراء هذه التجربة. قسمت الارانب عشوائيا الى سبعة مجاميع، كل مجموعة حوت سبع حيوانات، جرعت فمويا كل من المجموعة الاولى وحتى الثالثة بمسحوق نبات الجنسينج وبالجرع التالية 1جرام و3جرام و5جرام بالتتابع على شكل بودر. بينما اعطيت كل من المجموعة الرابعة وحتى السادسة 0.2 جرام و0.6 جرام و1جرام من مسحوق جذور نبات الجنسينج على شكل كبسولة بينما استخدمت المجموعة السابعة كمجموعة سيطرة. تم جمع عينات الدم يوميا لقياس تأثير نبات الجنسينج عل القيم الدموية **والكيمياء** للأرانب. اظهرت النتائج زيادة في نسبة الهيموجلوبين في كل من المجموعة الثانية والتي جرعت بجرعة 3 جرام من بودرة الجنسينج وبمتوسط حسابي (0.45 ±31.53)والمجموعة الرابعة والتي اعطيت 0.2 جرام من مسحوق الجنسينج على شكل كبسولة وكان المتوسط الحسابي (4.50±32.00) مقارنة بمجموعة السيطرة وبمتوسط حسابي (16.03± 1.45). أظهرت نتائج الدراسة عدم تأثير نبات الجنسينج على العد الكلي لكريات الدم البيضاء في كل مجاميع الدراسة ولا توجد أي فروق معنوية(P<0.05) بين تلك المجاميع. الدراسة الحالية أظهرت فروق معنوية في انخفاض نسبة انزيمات الكبد (AST, ALT, and ALP)، وكذا وعلامات الكلى مثل اليوريا والكرياتينين. خلصت هذه الدراسة الحالية الى إن جذور الجنسينج سواء على شكل بودر أو كبسول لها تأثيرات على القيم الدموية والكيمياء حياتية وهذا يفسر استخداماتها المختلفة في الطب التقليدي والطب البديل. توصي الدراسة بأجراء مزيدا من الدراسات على سمية نبات الجنسينج في الانسان والحيوان.

الكلمات المفتاحية: الارانب، القيم الدموية والكيمياء حيوية جذور الجنسنج، فعالية

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