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PROTECTIVE EFFECT OF KOREAN RED GINSENG ON THE HAEMATOLOGICAL PARAMETERS IN WISTAR RATS AFTER EXPOSURE OF ARTIFICIAL UV RAYS

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Abstract

UV radiation is a type of non-ionizing radiation emitted by the sun or other artificial sources. Artificial UV radiations effects on nervous, respiratory, excretory and circulatory system in particular which shows extreme alterations by the causation of free radicals. The experimental protocol includes 5 sets *viz*., UV-B exposed group, UV-B + KRG treated group, KRG + UVB treated group, KRG treated group and control. Peripheral blood was drawn at pre-determined time intervals to observe haematological parameters. Free-radicals produced by UV-B, alters the membrane structure of blood cells by oxidative damage leads to photohemolysis at the level of bone marrow which attained normalcy following Korean red ginseng (*Panax ginseng*) root extract in order to intellect vitality enhancement, stress resistance and reimposition of hemostasis which registered positivity.

Keywords: Photohemolysis, Oxidative stress, Ginsenosides, Haematological.

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Introduction

UV radiation from the sun is absorbed by everyone, and an increasing number of people are exposed to artificial sources used in industry, commerce, and recreation. Artificial light consists of visible light as well as some ultraviolet (UV) and infrared (IR) radiations, and some lamps' emission levels are thought to be harmful to the skin and eyes. The ultraviolet and blue wavelengths of light have the most potential for harm. The spectrum is comprised of wide range of electromagnetic waves such as UV-rays, visible light and infrared radiations (Hincu *et al*., 2010) of which UV-radiations are the critical factors for the initiation and development of various biological disorders. Three bands of UV such as UV-A (320-400 nm) UV-B (280-320 nm) and UV-C (100-280 nm) have been recognized as an important biological stressor for many species. UV-C being most energetic and having least wavelength compared to UV-A & UV-B breaks the ozone molecule in stratosphere and does not come to the earth's surface. On the other hand UV-B and UV-A are not having sufficient energy to break the ozone molecule but having longer wavelength than UV-C; finally reach the earth's surface (Kumar, 2009). Tanning beds, mercury vapour lighting, halogen, fluorescent, incandescent lights, lasers, and other artificial sources of UV radiation.

Obeying the laws of physics, when UV-B light come it may get reflected and refracted (transmitted). It interacts with skin, where a part of the same is reflected and dispelled in the corneous stratum; some gets absorbed into epidermis, while the rest is directed towards dermis (Hincu *et al*., 2010). UV-B i.e. mid wave not only affects the skin as being primarily exposed to but also affects the non-skin organs directly or indirectly by generation of RONS (Svobodara *et al*., 2011). These RONS attack biomolecules, their effect is not restricted to the local areas but spread to the cells of other tissues/ organs/ and systems such as nervous, excretory, respiratory and circulatory in particular.

It is with this reason artificial generation of UV-B has been seen to affect the circulatory system the most. As the haematopoietic system seems to be highly sensitive to these artificial UV-B radiations. Further, haematological parameters have been so selected to examine the adverse effect. Blood components having their own regenerative capacity mask the minor effects however reflect qualitative (deformity) and quantitative (numerical values) on increasing exposure schedule (Kumar, 2011). The present investigation highlights the detrimental effects of artificial UV-B radiations on haematological parameters with pre and post exposure to *Panax ginseng* as radiation modulator.

Materials and Methods

Experimental animal

Albino rats of wistar strain *Rattus norvegicus* (80-100 gm.) have been selected from inbreed colony for investigation.

Philips F-30TB as artificial source for UV-B radiations was used to expose the rats (Table 1). The exposure was given as per following equation

$$E = i \times t$$

Where, E = energy, i = illuminescence and t = time

Experimental plant: *Panax ginseng* (Korean Red Ginseng) was given orally as 10mg/kg of body weight of organism.

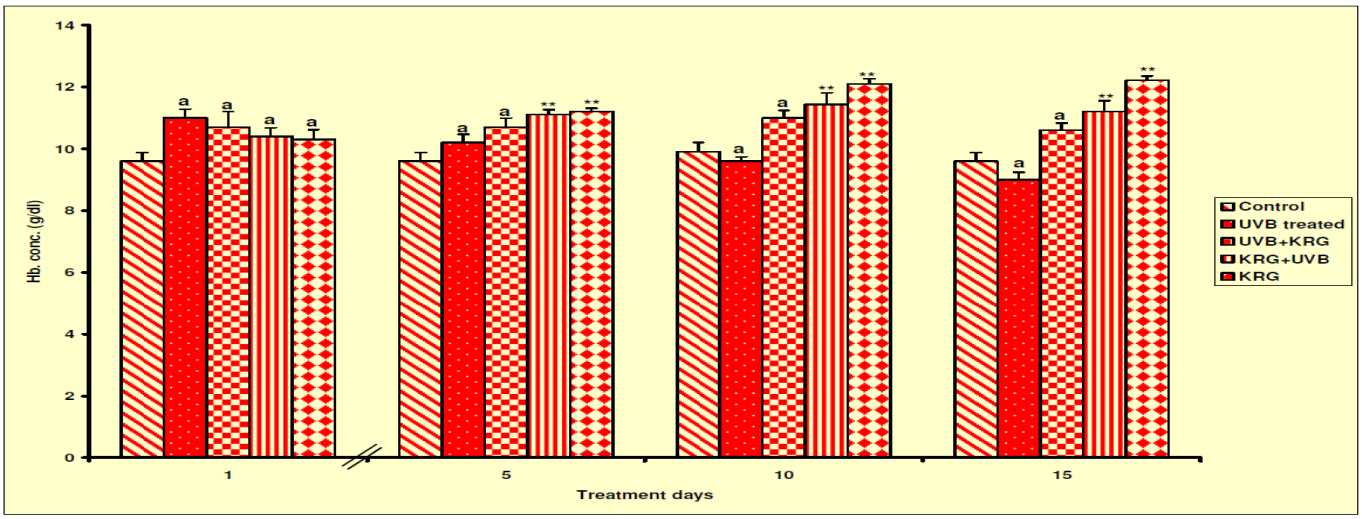
Treatment days	UV-B	UV-B + KRG	KRG + UV-B	KRG
1 days	0.44 J/cm^2 10 hours/day	0.44 J/cm^2 10 hours + KRG of 10mg/kg of body weight	10mg KRG/Kg of body weight + 0.44 J/cm^2 10 hour/day	10 mg KRG/ KG of body weight
5 days	0.055 J/cm^2 2 hours/day	0.088 J/cm^2 2 hours/day + 10 mg KRG/Kg of body weight	10mg KRG/Kg of body weight + 0.088 J/cm^2 2 hour/day	10 mg KRG/ KG of body weight
10 days	0.044 J/cm^2 1 hour/day	0.044 J/cm^2 + 1 hour/day + 10 mg KRG/Kg of body weight	10mg KRG/Kg of body weight + 0.044J/cm^2 1 hour/day	10 mg KRG/ KG of body weight
15 days	0.03134J/cm^2 40 minutes/day	0.03134 J/cm^2 + 40 minutes/day + 10 mg KRG/Kg of body weight	10mg KRG/Kg of body weight + 0.03134 J/cm^2 40 minutes/day	10 mg KRG/ KG of body weight

Haematological parameters

The total erythrocyte count and total leucocyte count were estimated by the method of Dacie and Lewis (1969), while haemoglobin concentration and packed cell volume were estimated by the method of Wintrobe *et al.* (1986). The data were analysed by ANOVA and SNK test for testing the significance of differences ($p < 0.05$) ($p > 0.01$).

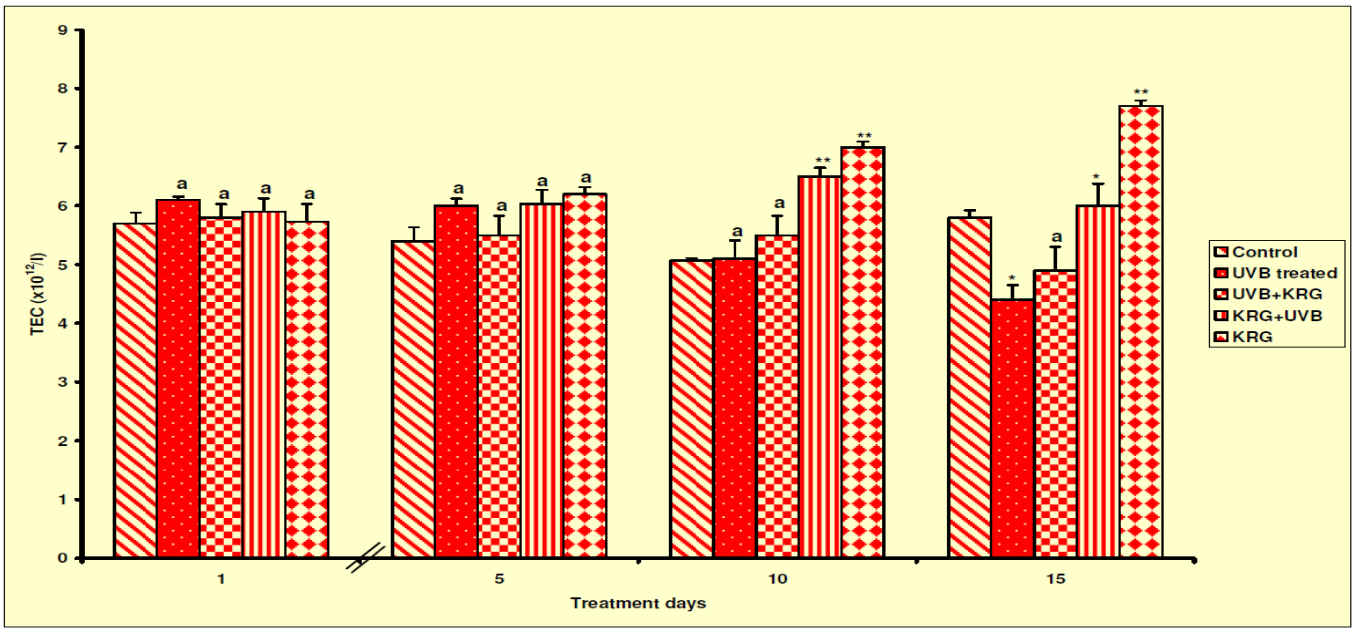
Observations

Haematological parameters reveal following alterations in (Fig.1-4)



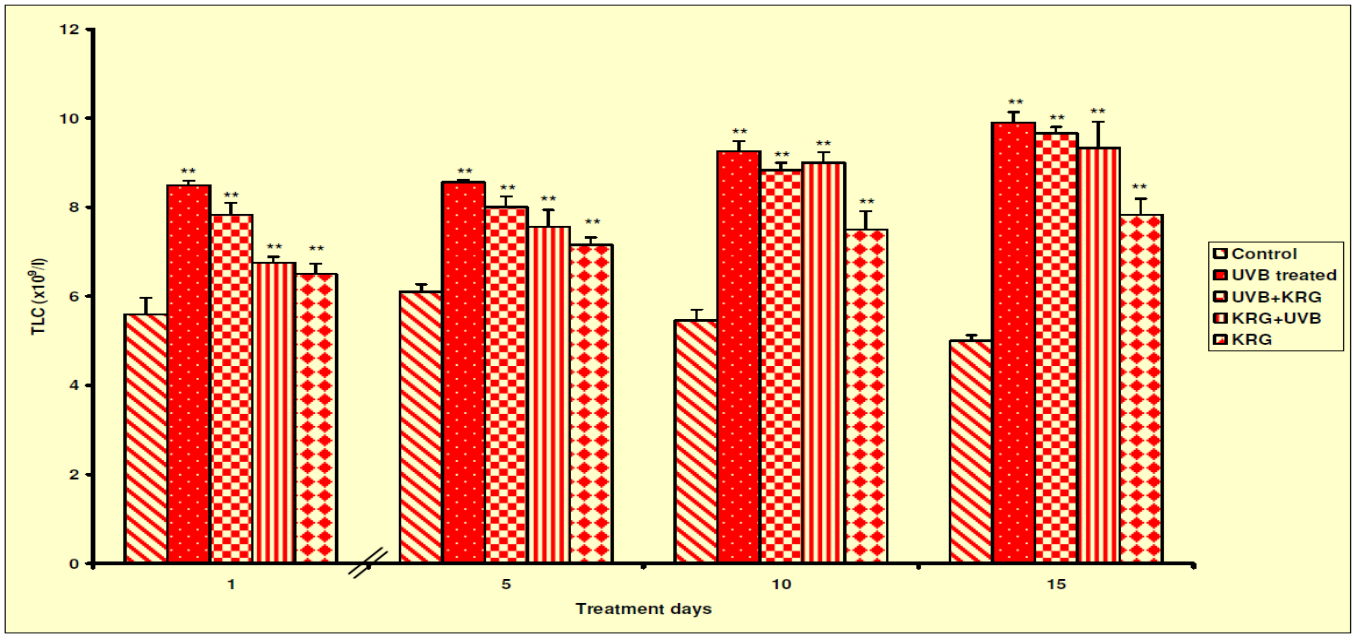
Significance level : * = P< 0.05, ** = P< 0.01 and a = P> 0.05

Fig. 1 : Effect of UV-B exposure and KRG treatment on Haemoglobin concentration (g/dl) in albino rats



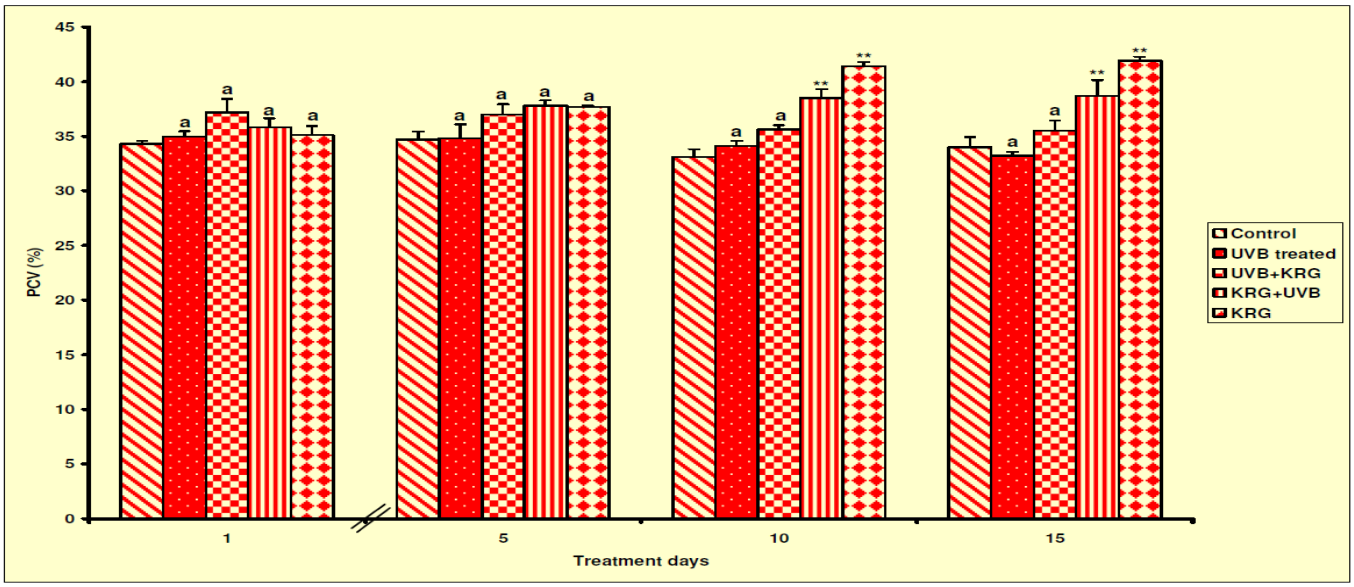
Significance level : * = P< 0.05, ** = P< 0.01 and a = P> 0.05

Fig. 2 : Effect of UV-B exposure and KRG treatment on TEC (x10^{12}/l) in albino rats



Significance level : * = P< 0.05, ** = P< 0.01 and a = P> 0.05

Fig. 3 : Effect of UV-B exposure and KRG treatment on TLC (x10^9/l) in albino rats



Significance level : * = P< 0.05, ** = P< 0.01 and a = P> 0.05

Fig. 4 : Effect of UV-B exposure and KRG treatment on PCV (%) in albino rats

Discussion

UV-B photons are less energetic, and only a small percentage of them reach the hypodermis, where they cause indirect damage by producing various derivatives such as RONS. However, a high concentration of reactive species depletes endogenous antioxidants, leading to more reactive species formation and oxidative stress. Modification of biomolecules (via signal transduction) is accompanied by changes in enzymatic activities, which eventually result in changes in function. UV-damaged biomolecules and signal molecules may enter the bloodstream and thus affect blood cells and internal organs (Svobodara et al., 2011). Furthermore, because of increased oxidative stress, deep penetration of UV-B photons may affect blood vessels in the dermis and thus blood (Soliman, 2004).

Biological membranes, which are primarily made up of protein and lipids, play an important role in cell survival as well as serving as an envelope for cellular components. The red blood cells of mammals are enucleated, disc-shaped, and have a biconcave cross-section (dumbbell resembling). Because the discoid shape provides the most surface area for gaseous exchange between cell tissues. It must withstand enormous shearing forces during its existence because it must pass through capillaries with a diameter much smaller than that of a resting cell. A previously UV-B exposed cell would be easily injured reveal greater RBC deformity under UV-B stress finally leading to hemolysis (Selim, 2009) and depletion of haemoglobin with simultaneous fall in values of TEC.

Lipid peroxidation, hydrolysis of phospholipid head groups, lipid-lipid crosslinks, disulfide bridge formation,

amino acid residue, damage in membrane proteins, and lipid protein cross links are all caused by free radicals formed during irradiation (Lee and Ducoff, 1994). Changes in the cytoskeleton of erythrocytes, in particular, can be influenced by membrane changes.

The combined effect of free radicals/RONS leads to decrease in values of Hb. concentration and TEC by hemolysis (Schon *et al*., 1994). But in the case of pre and post KRG treatment the effect is comparatively less as compared to UV-B exposure. Perhaps due to this fact the antioxidants of the ginseng neutralize the effects of RONS and keep the membrane/biomolecules/ RBC safe. Decrease in the value of RBCs and Hb leads to anaemia, myelosuppression and hypoxia.

It is already reported that WBCs provide the body defense mechanism so any alteration in the normal physiological status may thus lead to leucocytosis. It is well established that UV-B leads so many changes such as erythema, sun burn, skin cancer, dermatitis, damages of DNA, eye etc. (Rapp and Ghalayini, 1999). UV-B exposure mainly to skin, as being first line of defense, releases the interleukins from melanocytes and keratinocytes which activate the bone marrow to secrete its leucocyte stores in the peripheral blood circulation (Cten and Altnsaat, 2006). Interleukin IL-2, IL-4, IL-6, IL-10 are found for secretion of neutrophils and easinophils and finally leads to leucocytosis (Garssen *et al*., 1999; Boonstra *et al*., 2000 and Slominski and Pawelek, 1998). In the pre and post KRG treatment, it is observed that the values also get increased as in case of UV-B exposed group. It is due to antioxidants present in KRG which show their immunoprotective, immunomodulatory and immunoproliferative actions.

The PCV reduction in UV-B exposed group is more than in the set previously exposed to KRG. The reduction in PCV may be responsible for haemoglobin reduction and finally cause iron deficiency anaemia.

Antioxidant defence systems are overwhelmed by cytotoxic agents, resulting in significant damage to macromolecules like carbohydrates, proteins, fats, and nucleic acids through biomolecular oxidative modification of these macromolecules. (Yu, 1994). To overcome such oxidative stress it becomes important for cells to maintain normal antioxidative defense to reduce such damages. Ginsenosides present in ginseng overwhelm the damages via lipid peroxidation inhibition and the scavenging of free radicals or via an increase in superoxide dismutase activity (Xie *et al*., 1993 and Abdel-Wahhab and Ahmed, 2004). Based on the significant numerical alteration in haematological parameters *vide supra*, it is evident that artificial UV-B has sufficient damaging effects which have been minimized by using *Panax ginseng* root extract in the present investigation, Artifical UV-B induces haematological alterations which gets modulated by Korean red ginseng in wistar rats. The antioxidant activities of ginsenosides attribute a major activity in protective and therapeutic role in various diseases. The inhibitory effect of (Rb1) ginsenosides on UV-B stress induced changes in level of numerical values in haematological parameters suggest that ginsenosides may block the stress due to their antioxidants with enhancement in immunomodulation, antistress and restoration of haemostasis by acting as scavengers of free radicals and enhancement of enzymatic activity.

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