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ANTITUMOUR AND RADIOPROTECTIVE ACTIVITY OF ALOE VERA

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ABSTRACT
The aim of the study was to determine the anti tumour and radio protective activity of Aloe vera. The tumour study was conducted in ascites tumour model and in solid tumour model. In solid tumour model a significant result was obtained when the extract of Aloe vera was administered to animal models. In radio protective study even though there was no significant effect of drug along with radiation induced animal's body weight, haemoglobin and in differential count there was a slight increase in Total WBC count in drug induced animals along with radiation when compared with radiation alone treated animals

KEY WORDS: DLA, WBC, Ascites tumour, Solid Tumour, Aloe vera, Mice.

INTRODUCTION

Radiotherapy is one of the most successful forms of treatment modality available against cancer. 80% of the cancer patient needs radiotherapy at some time or other, either for curative or palliative purpose (Withers, 1999). The ability of ionizing radiation to kill the cancer through the induction of cell damage makes this an important modality in the therapeutic approach against cancer in humans. But radiation often causes damage to surrounding normal issue on well (Bandyopahyay *et al*., 1999). Occupational radiation exposure and nuclear accidents are also known to cause enormous damage to tissue. Higher dose of radiation are known to cause genetic defect (Sies, 1997). The interaction of ionizing radiation with biological systems results in the generation of free radicals. Since human tissue contain 80% water, the major radiation damage is due to the aqueous free radicals generated by the action of water .The main free radicals resulting from aqueous radiolysis are $O^{\cdot 2-}$ (super oxide) HO_2 (hydroperoxyl radical), HO^{2-} (peroxide ion), hydrogen peroxide and OH (hydroxyl radical). The free radicals react with cellular macromolecules and cause cell dysfunction and mortality. These reactions take place in tumors as well as normal cell (Maunch *et al*., 1995). The radiation damage to a cell is potentiated in the presence of oxygen. In the presence of oxygen, hydrated electrons and hydrogen atoms react with molecular oxygen and produce free radicals such as hydrogen peroxide, O^{2-} apart from other aqueous free radicals (Uma Devi, 1998). The increase in the sensitivity of cells to ionizing radiation in the presence of oxygen compared to that in its absence is termed as Oxygen effect. The oxidative damage to the cellular genetic machinery plays an important role in carcinogenis and mutagensis. Radiation is known to cause single and double strand breaks in DNA. Damage to DNA may result in immediate cell death or at the next mitosis by fully repaired or result in a permanent mutation in the genotype which may be transmitted from one generation to another (Nair, 2001). Free radicals also cause damage to proteins. Membranes are considered to be one of the main target of free radicals attack results in changes in the membrane permeability, loss of fluidity and loss of integrity which leads to cell death. Free radicals also cause lipid peroxidation and extent of lipid peroxidation depends on the dose of radiation (Weiss, 1997).

Aloe vera

A coarse looking perineal with a short stem and fleshy leaves found wild in many parts of country. Dried juice of leaves is used in diseases of Abdomen. dysmenorrhoea, fever, liver disorder. 99.5% of *Aloe vera* is water. The pH is 4.5. The remaining solid part contain vitamin, minerals, enzymes, sugars, anthraquinones or phenolic compounds, lignin, saponins, sterols, amino acids and salicylic acids.

MATERIALS & METHODS

Drug: A*loe vera ,* Radioactive materials: - The source of radiation was a ^{60}*Co Theratron-Phoenix teletherapy unit,* PBS, Turk's Diluting fluid, Leishman's stain, Typan blue,0.1% CMC (Carboxy methyl cellulose), Diagnostic, Research and Reagent Kits: Drabkins reagent, Dalton's Lymphoma ascites (DLA cells), Swiss albino and Balb/c mice (20-25g), Lyophiliser, Spectrophotometer, Research Microscope

Anti tumour study of Aloe vera

In ascites tumour model DLA cells were injected into the peritoneal cavity. Group I was kept as untreated control, Group II and Group III were supplemented with aqueous extract of *Aloe vera* 0.1% (100mg/kgb.wt); (20mg/kgb.wt) respectively for 15 consecutive days. Percentage increase in life span was calculated.

Insolid tumour model the DLA cells were injected intramuscularly to the right hind limb of three groups. Group I was kept as Untreated control l. Group II and Group III was supplemented with aquoeus extract of *Aloe vera* (200mg/kgb.wt); (50mg/kgb.wt) orally respectively for 15 days. Radii of developing tumour were measured

using vernier calliper at 4 days interval and tumour volume was calculated.

Radioprotective action of Aloe vera

Animals were exposed to whole body radiation using ^{60}Co Theratron-Phoenix teletherapy. The effects of Aloe vera on Haematological parameters of irradiated animals were deremined.GroupI was kept as control. Group II and Group III were treated with 100mg/kgb.wt, 20mg/kgb.wt of extract of *Aloe vera* 5 days prior to irradiation and treatment was continued for another 28 days after irradiation.

Body weight, Total WBC, Differential Count, Haemoglobin were determined

RESULT

From Table 1 we noticed that the aqueous extract of *Aloe vera* did not produce any cytotoxic response to DLA cells during short incubation time period.

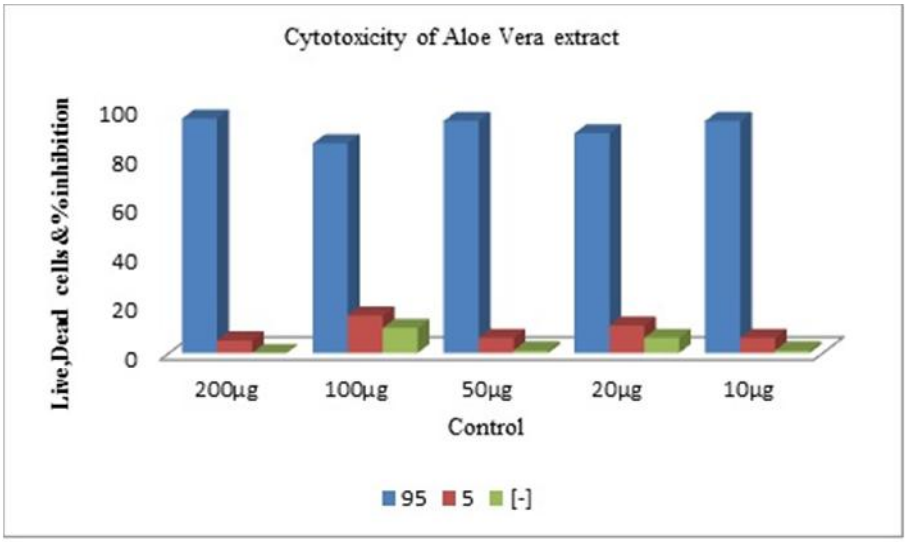

FIGURE 1. Cytotoxicity of A*loe vera* extract

Figure 2 shows that extract of a pulp of *Aloe vera* did not have significant effect on ascites tumour induced by DLA cells

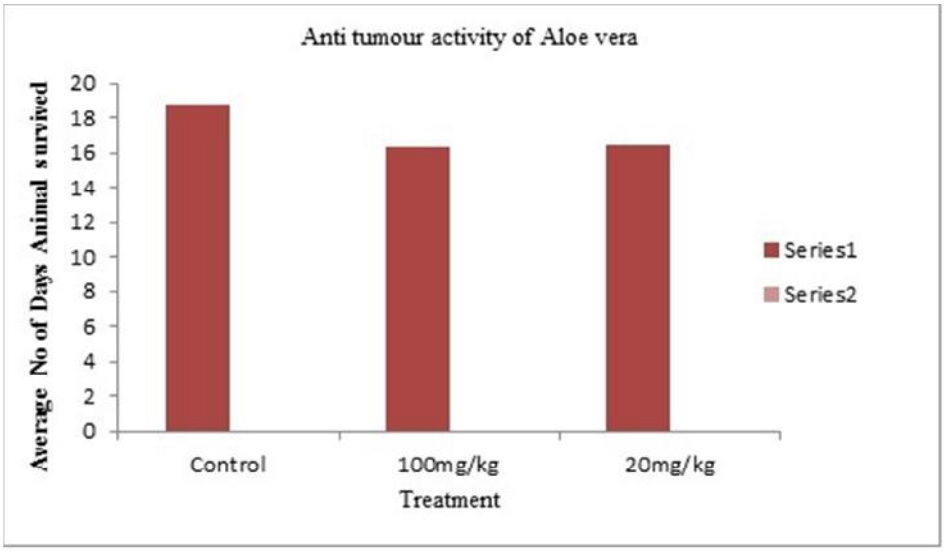

FIGURE 2. Anti tumour activity of A*loe vera* (ascites tumour model)

Fig 3 shows that in solid tumour model the *Aloe vera* extract had a significant effect. Treatment of *Aloe vera* extract significantly reduced tumour volume. Percentage Inhibition in tumour volume after treatment with *Aloe vera* on day 31 was 91.9 %(200 mg/kg.b.wt).The tumour volume on day 31was 0.3 and the Percentage decrease in tumour volume was 40 % (50 mg/kg.b.wt)

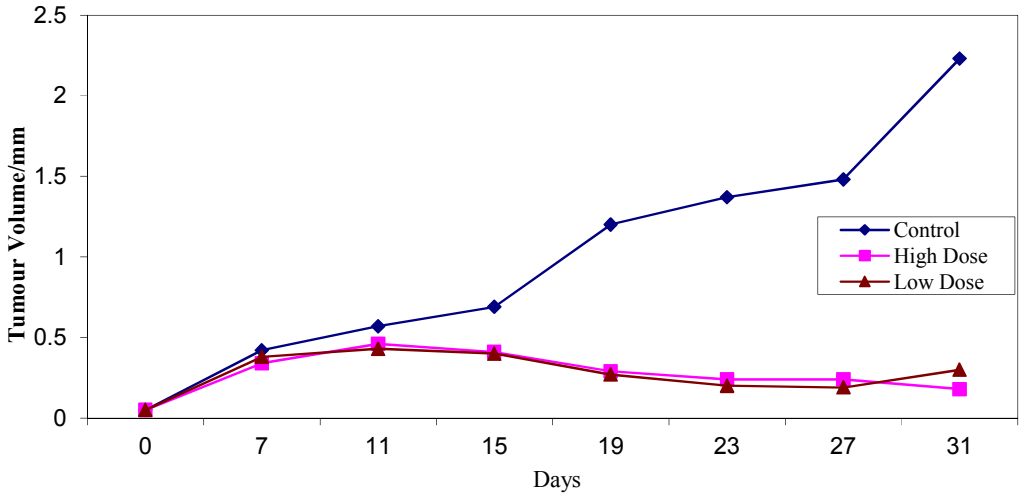

FIGURE 3. Effect of A*loe vera* on solid tumour development induced by dalton lymphoma ascites tumour cells (**p< 0.01; ***p< 0.001)

Effect of *Aloe vera* on Body weight (fig 4) and Haemoglobin (fig5) did not have any significant effect when compared

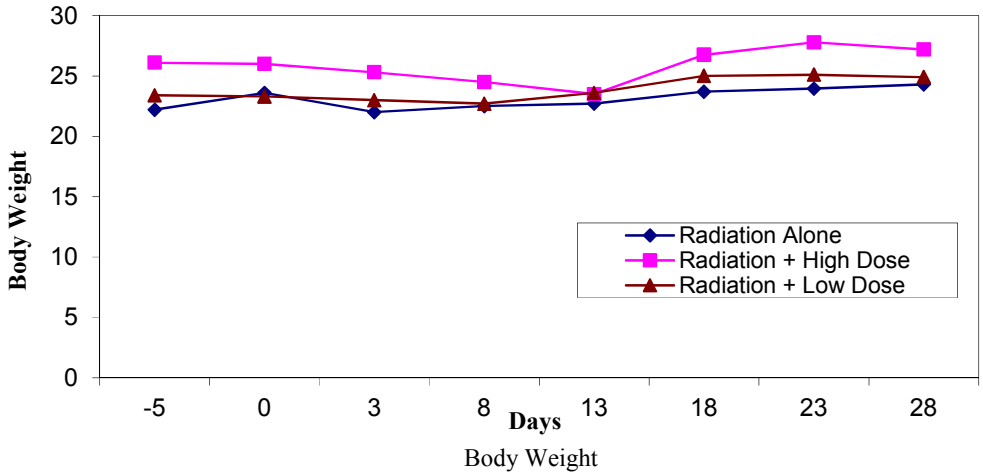

FIGURE 4. Effect of A*loe vera* on the body weight of irradiated animals

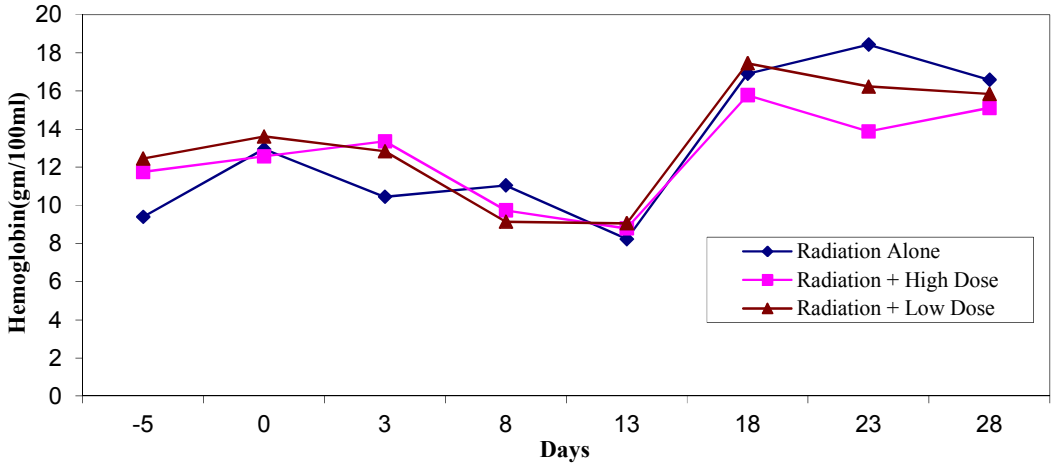

FIGURE 5. Effect of *Aloe vera* on the hemoglobin level of irradiated animals

The Total WBC (Fig 6) in mice treated with *Aloe vera* was found significantly reduced (3rd day) and afterwards the

value were found increased. This decrease was also found in radiation treated animals also. However Maximum decrease in total WBC was 2733 in drug treated animals and this number was higher than that of radiation alone treated animals. These result indicated that *Aloe vera* extract partially improves the WBC count in mice after radiation treatment thus preventing leukepenia.

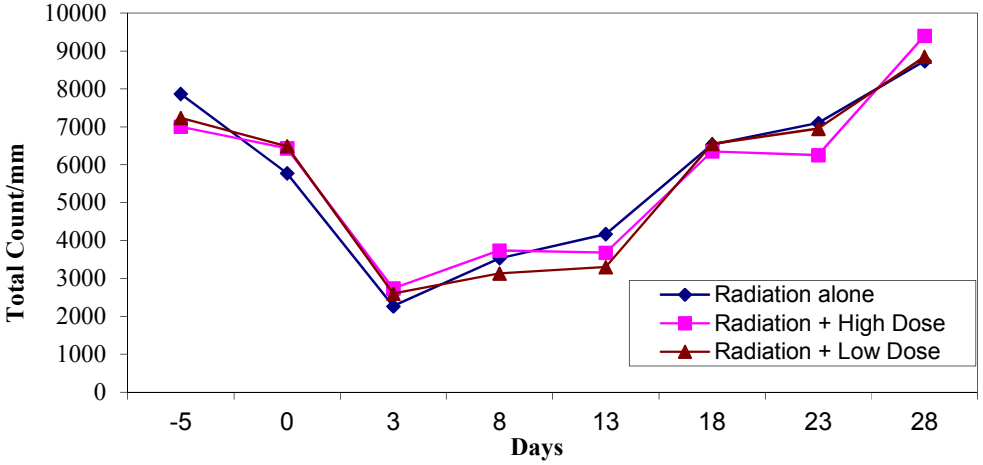

FIGURE 6. Effect of *Aloe vera* on total WBC count of irradiated animals

Figure 7 shows that administration of *Aloe vera* extract along with radiation did not have significant alteration on differential count of Leukocytes when compared to radiation alone treated animals.

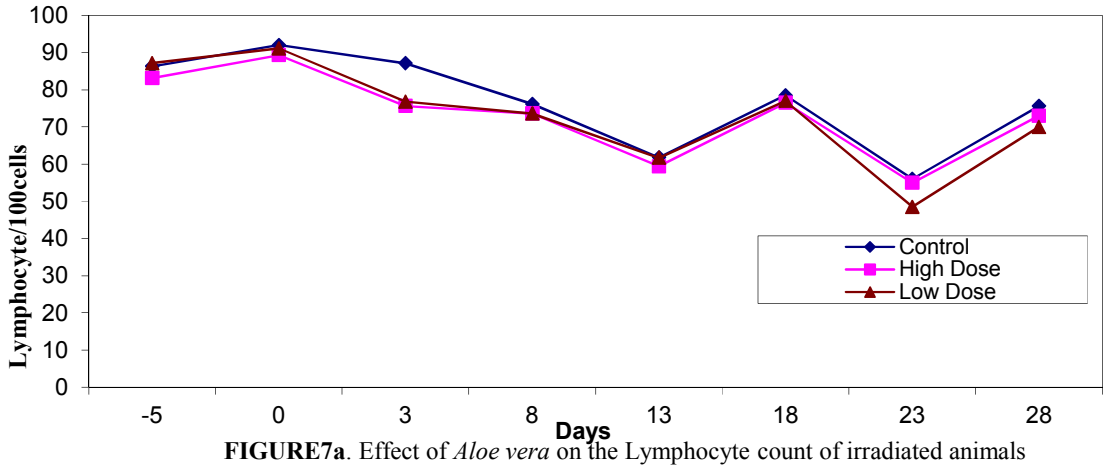

FIGURE7a. Effect of *Aloe vera* on the Lymphocyte count of irradiated animals

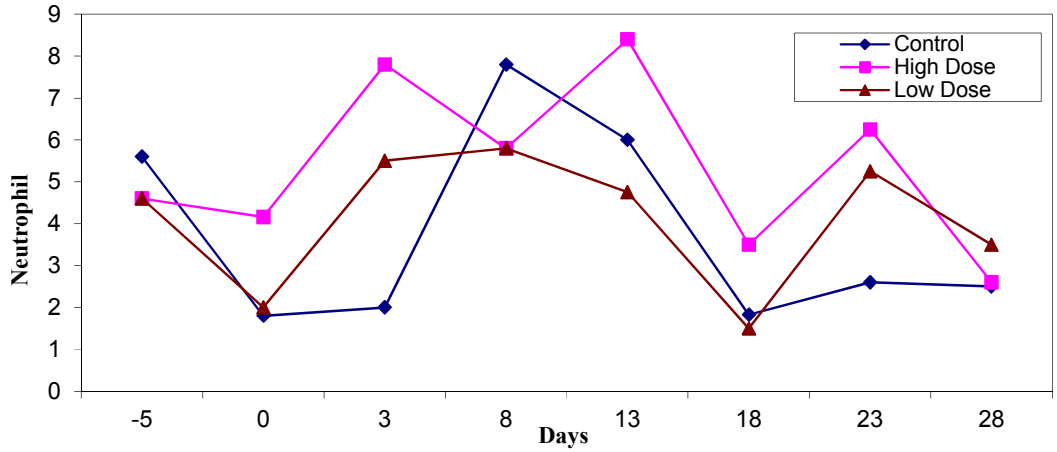

FIGURE 7b. Neutrophil

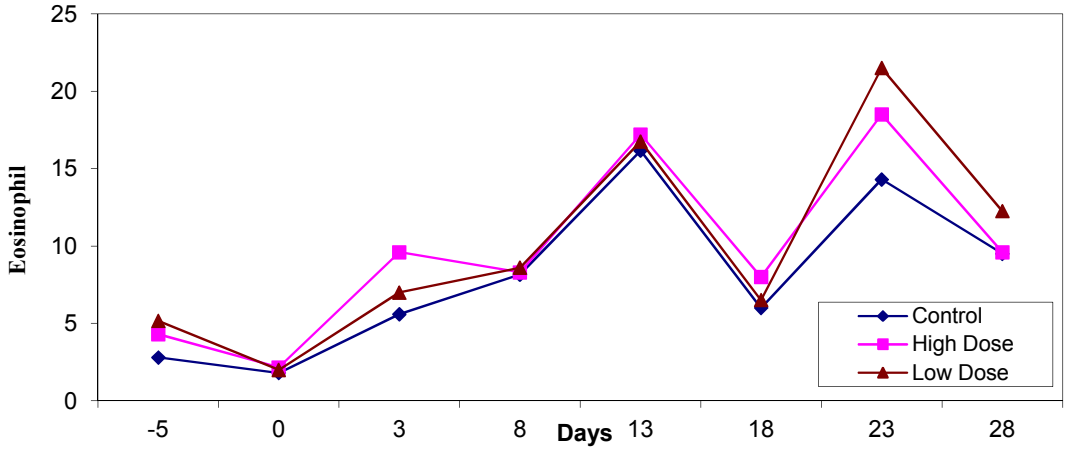

FIGURE 7c. Eosinophil

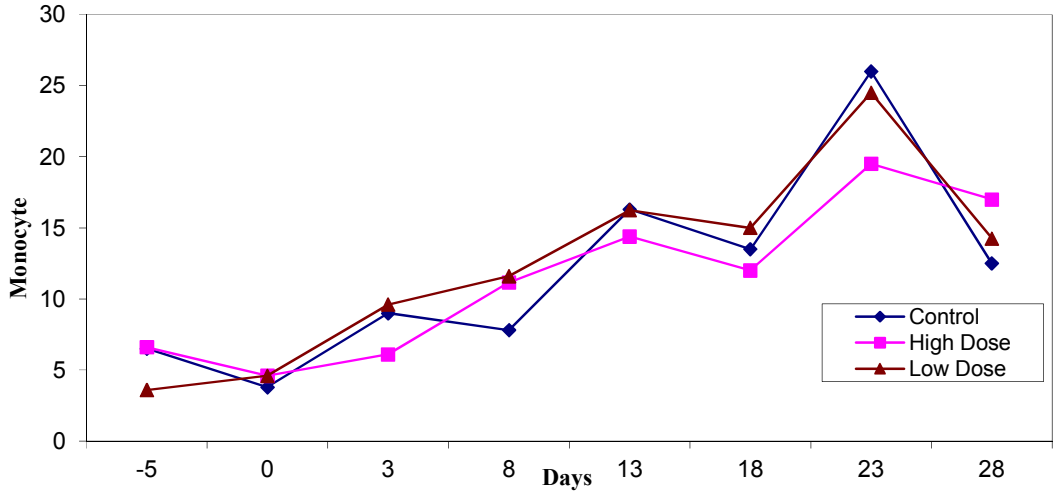

FIGURE 7d. Monocyte

DISCUSSION

In this study the antitumour activity and radioprotective activity of *Aloe vera* was determined. In ascites tumour model, animal injected with DLA cells did not show any significant effect on the increase in life span. In solid tumour model, the extract of *Aloe vera* showed a significant reduction on the tumour developed in animals. In the treated animals there was an inhibition up to 91.9% of tumour development Antitumour effect and mechanism of aloe polysaccharides have been studied. Aloe polysaccharide which was antitumor activity, enhance antitumor activity of chemotherapy drugs and reduce its side effects. The effect was derived from inducing IL-2 and TNF producing in body and thus improved the immune system. The radio protective activity of *Aloe vera* extract was also determined in this study. Body weight of treated animals did not allow difference when compared to radiation alone treated animals. The Total WBC count was found to be high in Aloe treated animals when compared to control. Hemoglobin and differential count of leukocytes did not show significant difference compared to control. *Aloe vera* stimulated IL-2 and TNFα (Agarwal and Singh, 1999) provides a radioprotective activity, *Aloe vera* is shown to be effective for treating radiation induced burns (Chitra *et al*., 1998). *Aloe vera* extract is useful for inflammation and wound healing (Ramachandiran and Maniyan, 1989; Ignacimuthu *et al*., 1998). *Aloe* treatment contributes to reduction of tumour mass, metastatic foci and metastasis frequency at different stages of tumour progress without affecting major tumour growth. *Aloe* success potentiates anti tumour effect of 5 flurorouracil and cyclophosphamide as components of combination chemotherapy. The results obtained in this study suggest the potential antitumor and radio protective effect of *Aloe vera* which require further study to explore their complete usefulness in cancer therapy. .

REFERENCES

Agarwal, S. S. & Singh, V. K. (1999) Immunomodulation: A review of studies on Indian medicinal plants and synthetic peptides. *Proc. Indian National Academy of Science, B* 65-79-204.

Bandyopandhyay, U., Das, D. and Banerjee, R.K. (1999) Reactive oxygen species: oxidative damage and pathogenesis, *Current Sci.,* **77**-658.

Chira, P., Sajithlal, G. B., Chandrahasan, G. (1998) Influence of *Aloe vera* on collagen characteristics in healing dermal wounds in rats. *Mol. Cell Biochemical* **181**, 71-76.

Ignacimuthu, S. Sankarasivaraman, K. and Kesavan, L. (1998) Medico ethanobotanical survey among Kanikar tribal of Mundanthurai sanctuary,Western ghats, India. *Fitoterapia,* **69**,409-414.

Maunch, P., Constine, L., Greenberg, J., Knospe, W. L. Leveld, J. L. and Deeg, H. J. (1995) *Int J Rad Onco Biol Phys*, **31**, 1319-1339.

Nair, C. K. K., Parida, D. K. and Nomura, T. (2001) Radioprotectors in radiotherapy,*J. radiat Res*, **42**, 21-37.

Ramachandran, V. S. and Manian, S. (1989) Ethanobotanical notes on the Irulas Koravas and Puliyas of Coimbatore district, Tamilnadu. *Indian Bot Rept* **8**, 85-91.

Ramachandran,V. S. and Manian, S. (1989) Ethanobotanical notes on the Irulas Koravas and Puliyas of coimbatore district, Tamilnadu. *Indian Bot Rept* **8**: 85-91.

Sies, H. (1997) Oxidative stress: Oxidants and autioxidants *Exp Physiol*, 82-291.

Uma Devi, P. (1998) Normal tissue protection in cancer therapy: Progress & prospects, *Acta Oncol*, **37**: 247-251.

Weiss, J. F. (1997) Pharmacological approach to protection against radiation induced lethality and other damages.*Environmental Health Perspect*.**105**:1473-1478.

Withres, R. H. (1999) Radiation Biology and Treatment Options in Radiation Oncology.*Cancer Research* (Suppl) **59:**1676s-1684s..