Effect of Spirulina and Ginger Against Radiation Hazards on Mandibular Alveolar Bone of Albino Rats (Histological, Immunohistochemical and Radiographic Study)

Original Article

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ABSTRACT

Background: Radiotherapy has produced a significant increase in cure rates for many malignancies of the head and neck region. Herbal medicine products are a natural alternative of radioprotectors which is important to manage pathological conditions caused by free radicals produced by ionizing radiations. Spirulina and ginger possess radioprotective action through their scavenging mechanisms and antioxidant potential.

Aim of Study: To evaluate the possible action of spirulina and ginger on alveolar bone of lower jaw after exposure to radiation in albino rats.

Materials and Methods: 20 adult male albino rats were equally divided into 4 groups: Control Group (CG): rats received no radiation or treatment. Irradiated Untreated Group (IUG): rats received a single dose of gamma irradiation (6.5Gy). Spirulina Treated Group (STG): rats received 20ml/kg/day of spirulina for a week after irradiation. Ginger Treated Group (GTG): rats received 20ml/kg/day of ginger for a week after irradiation. At the end of the experiment, mandibles were dissected and examined histologically, immunohistochemically and radiographically.

Results: Hematoxylin and eosin (H&E) results of CG revealed alveolar bone proper with a regular outline and lined with osteoblasts. IUG showed degenerated areas in alveolar bone and reversal lines. STG and GTG represented relatively irregular socket wall and degeneration in some areas of alveolar bone. Masson trichrome results of CG and GTG revealed immature collagen intermingled with mature collagen. IUG and STG showed immature collagen. Proliferating cell nuclear antigen (PCNA) results in CG and IUG showed positive immunoreaction with mild intensity of osteoblasts and osteocytes. STG showed severe intensity, while GTG revealed moderate intensity. Radiographically, alveolar bone around the roots showed radiopacity in CG and STG, while in IUG and GTG showed radiolucency.

Conclusions: Exposure to gamma radiation had destructive effect on alveolar bone. Spirulina and ginger have radioprotective action against the deleterious effects of radiation.

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Key Words: Alveolar bone; ginger; PCNA; radiation; spirulina.

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INTRODUCTION

Alveolar process consists of alveolar bone proper and supporting alveolar bone. The alveolar bone proper is a thin lamella of bone surrounding the root of the tooth and provides attachment to the periodontal ligament (PDL) fibers, while the supporting alveolar bone surrounds and supports the alveolar bone proper[1].

Radiotherapy has produced a significant increase in cure rates for many head and neck malignancies. However, high radiation doses in large areas as the mandible may result in many undesired reactions that appear during or after the radiation therapy[2].

Interest has risen in the development of potential drugs of plant/herbal origin to overcome radiation effects. Spirulina is a microscopic and filamentous cyanobacterium (commonly called blue-green alga). It possesses antioxidant, anti-inflammatory and immune-enhancing properties that help in prevention of different disorders that are associated with oxidative stress and inflammation[3].

Ginger "Zingiber officinale" is a spice and flavoring agent consumed worldwide. It contains various compounds that have antioxidant, anti-inflammatory and free radical scavenging properties[4].

This study aimed to assess the histological and radiographical changes of albino rat's mandibular alveolar bone after irradiation exposure and to evaluate the possible effect of spirulina and ginger against irradiation hazards.

MATERIALS AND METHODS

This study was approved by the Research Ethics Committee, Faculty of Dentistry, Ain Shams University, Cairo, Egypt. Committee approval number FDASU-Rec D021716.

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Animals

20 adult male albino rats, with average weight of 200-250gm and with average age 7weeks old were used in this study. The rats were housed in separate wire mesh dated cages, 5 rats per cage in the Animal House of Medical Research Center, Ain Shams University under the supervision of a specialized veterinarian. Temperature and humidity conditions were controlled as possible during animal housing. Rats were fed an adequate stable diet consisted of fresh vegetables, dried bread and tap water ad libitum throughout the experimental period.

Irradiation: whole body-irradiation of rats was performed by using 137Cesium biological irradiator source, Canadian-Cell-40, located at the National Centre for Radiation Research and Technology (NCRRT), Egyptian Atomic Energy Authority, Cairo. A single irradiation dose (6.5Gy) was applied with rate of 0.64Gy/min[5].

Materials

- Spirulina: was obtained in a form of powder loaded in a plastic container and was purchased from (Holland & Barrett B.V. Company, Huys Europa, Piet Heinkada, GM, Amsterdam).
- Ginger: was obtained in a form of powder loaded in a glass container and was purchased from (Imtenan Health Shop, the Industrial Area, Obour City, Cairo).

Methods

Spirulina and ginger suspensions were prepared with an amount of 20gm of spirulina powder and 20gm of ginger powder, each dissolved in 1L of distilled water.

Rats were equally divided into four groups (5 rats each) as follows:

1. Control Group (CG): rats neither received radiation nor treatment.
2. Irradiated Untreated Group (IUG): rats received a single dose of gamma irradiation (6.5Gy).
3. Spirulina Treated Group (STG): after irradiation, rats in this group received 20ml/kg/day of previously prepared spirulina suspension with a gastric lavage for a week[6].
4. Ginger Treated Group (GTG): after irradiation, rats in this group received 20ml/kg/day of previously prepared ginger suspension with a gastric lavage for a week[7].

Samples preparation

At the end of the experiment, rats in all groups were sacrificed after one week of irradiation and treatment by overdose of anesthesia (thiopental sodium, 100mg/kg) via an intraperitoneal injection. The mandible from each rat was dissected and the rest of rats' bodies were appropriately disposed at the incinerator of Ain Shams Hospital.

Each mandible was divided into 2 halves, the right half was used for histological and immunohistochemical evaluation, while the left one was used for the radiographic evaluation.

Hematoxylin and Eosin stain (H&E)

The right half of mandible specimens (molar area) were fixed at 10% buffered formaldehyde for five days then decalcified using 12% Ethylene diamine terta-acetic acid (EDTA) buffered in pH 7.2[8]. Decalcified mandible specimens were washed properly under running water, dehydrated by transferring through ascending concentrations of alcohol then transferred to xylol to clear the specimen from alcohol. The specimens were then infiltrated in paraffin wax and embedded in the center of paraffin wax blocks. The embedded specimens were sectioned by microtome (4-5microns thick) then transferred in descending concentrations of alcohol. Finally, the sections were stained by H&E stain for routine histological examination under light microscope[9].

Masson trichrome stain

Paraffin embedded specimens were cut and placed on standard microscopic slides. After deparaffinisation and rehydration, the specimens were then immersed in Bouin's solution at 56°C for 15min. The slides were washed with tap water for 5min then stained in Weigert's hematoxylin for 5min and rinsed in distilled water. After that, the specimens were stained in Biebrich scarlet-acid fuchsin for 5min, rinsed then incubated in phosphotungstic-phosphomolybdic acid for 5min, dyed with aniline blue for 5min, fixed in 1% acetic acid for 2min and finally rinsed then dehydrated and mounted[10].

PCNA immunohistochemical staining

For PCNA staining, sections were deparaffinized then washed in ethanol. The slides were washed using phosphate buffer saline (PBS). Afterwards, sections were incubated in hydrochloric acid for 30min at room temperature and washed in PBS. The slides were pre-incubated in 5 % blocking serum for 30min then incubated in primary antibody diluted in PBS containing 1% bovine serum albumin at 4°C overnight. After that sections were incubated with a biotinylated horse anti-mouse IgG, diluted in PBS with 1% bovine serum albumin at 42°C for 20min, then incubated with avidin DH-biotinylated horseradish peroxidase H complex for 20 min at 42°C. Lastly, the sections were developed in a substrate solution of 0.05 % diaminobenzidine tetrahydrochloride (DAB) and 0.01% hydrogen peroxide for 3min then washed, counter stained with hematoxylin, dehydrated and mounted in DPX[11].

All images for H&E (x100&x200), Masson trichrome (x200) and anti-PCNA antibody (x400) were captured using digital camera (EOS 650D, Cannon, Japan) mounted on light microscope (BX60, Olympus, Japan) at Oral Biology Department, Faculty of Dentistry, Ain Shams University.

Radiographic Analysis

The left side mandibles were collected to determine the change in the bone density. Standardized radiographic images were obtained using wall-mounted digital intraoral x-ray machine and digital intraoral film. The images were displayed using VistaScan digital radiographic system. The radiographic images were performed at the Radiology Department, Faculty of Dentistry, Ain Shams University, Cairo, Egypt.

Histomorphometric Analysis

The histomorphometric analysis of the alveolar bone was carried out by using image J software. Three images from three different fields per each slide of Masson trichrome (for measuring area % of newly formed collagen) and anti-PCNA antibody (for osteoblast and osteocytes cells counting) were used. For area%, the images were transformed into a grey delineated image. Areas of interest were masked by a blue binary color. For bone cells counting, adjustment of images brightness was done to visualize only the positive cells then images were converted into binary black and white type then watershed. All calculations of the area% and cell count were performed in relation to a standard measuring frame (120000μm2).

Statistical Analysis

Data from histomorphometric analysis were represented as mean and standard deviation (SD) values. Data were coded and entered using the statistical package for the Social Sciences (SPSS) version 26 (IBM Corp., Armonk, NY, USA). Comparisons between groups were done using analysis of variance (ANOVA) with multiple comparisons post hoc Tukey test.

RESULTS

Histological Results

H&E stain

Control Group (CG)

Examination of the H&E stained sections of the CG revealed well organized PDL fibers surrounded by alveolar bone proper with a nearly regular outline and lined by osteoblasts. Zuckerkandl and Hirschfeld canals were detected (Figure 1a). Numerous osteocytes and fibrocellular marrow cavities lined by osteoblasts were seen. Slightly undulated resting lines were evident (Figure 1b).

Irradiated Untreated Group (IUG)

The histological examination of this group showed apparently degenerated areas in PDL fibers. Relatively scalloped and irregular socket walls lined by osteoblasts. Fibrocellular marrow cavities and reversal lines as well as degenerated areas in alveolar bone and absence of osteoblastic lining cells were observed (Figure 1c). Some osteoblasts lining socket walls appeared flattened. Numerous osteocytes were detected, some with flattened lacunae and other lacunae were containing osteocytes with hyperchromatic nuclei. Resting line was spotted (Figure 1d).

Spirulina Treated Group (STG)

This group revealed some degenerated areas within PDL fibers. Socket walls were relatively irregular and lined by osteoblasts. Degeneration in some areas of alveolar bone was detected (Figure 2a). Socket wall was lined by osteoblasts with flat shape. Numerous osteocytes were observed. Fibrocellular marrow cavities lined by osteoblasts as well as reversal lines were seen (Figure 2b).

Ginger Treated Group (GTG)

Histological examination showed most of the PDL fibers appeared well organized, while some showed areas of degeneration. Nearly irregular socket walls lined by osteoblasts were observed (Figure 2c). Extravasated red blood cells (RBCs) were seen within PDL fibers. Socket wall was lined by osteoblasts, some of them showed hyperchromatic nuclei. Plump-shaped and flat osteocytic lacunae as well as osteocytes with hyperchromatic nuclei were noticed. Fibrocellular marrow cavities lined by osteoblasts, resting and reversal lines were observed (Figure 2d).

Masson trichrome stain

Masson trichrome was used for detection of newly formed (immature) collagen fiber that appeared as blue color and old formed (mature) collagen fiber that appeared as red color.

Histological examination of CG and GTG revealed blue areas of immature collagen intermingled with red areas of mature collagen (Figures 3a,d). IUG and STG showed blue areas of immature collagen (Figures 3b,c).

Immunohistochemical Results

Anti-PCNA antibody was used as a marker of cell proliferation. Positive immune reaction was seen as brown cytoplasmic staining of cells.

All groups revealed anti-PCNA positive immunoreaction of osteoblasts and osteocytes of the alveolar bone with different staining intensity. In the CG and IUG immunoreaction showed mild intensity (Figures 4a,b). STG showed severe intensity (Figure 4c). While GTG revealed moderate intensity (Figure 4d).

Radiographic results

The CG and STG showed uniform radiopaque areas of mandibular bone. While apparent areas of radiopacity of alveolar bone around the roots of mandibular molars were spotted (Figure 5a,c).

In IUG, apparent little area of radiolucency of mandibular bone was detected. Also nearly wide interproximal and interradicular radiolucent areas of alveolar bone surrounding molars roots were seen (Figure 5b).

In GTG consistent areas of radiopacity of mandibular bone were detected. Apparent interproximal areas of radiolucency of alveolar bone surrounding the roots of molars were noticed (Figure 5d).

Statistical Results

Statistical analysis of area% of newly formed collagen

There was statistically significant difference between GTG in comparison to CG and IUG groups, however there was no statistically significant difference between STG and other studied groups. GTG showed the highest statistically significant mean area% of newly formed collagen followed by STG then CG respectively. IUG showed the lowest mean area% of newly formed collagen (Table 1, Figure 6a).

Statistical analysis of anti-PCNA antibody immunopositive bone cells count (osteoblasts and osteocytes)

There was no statistically significant difference between both treated groups and IUG, however they showed statistically significant difference with CG. GTG showed the highest statistically significant mean value of immunopositive bone cells count followed by STG and IUG respectively. CG showed the lowest mean value of immunopositive bone cells count (Table 2, Figure 6b).

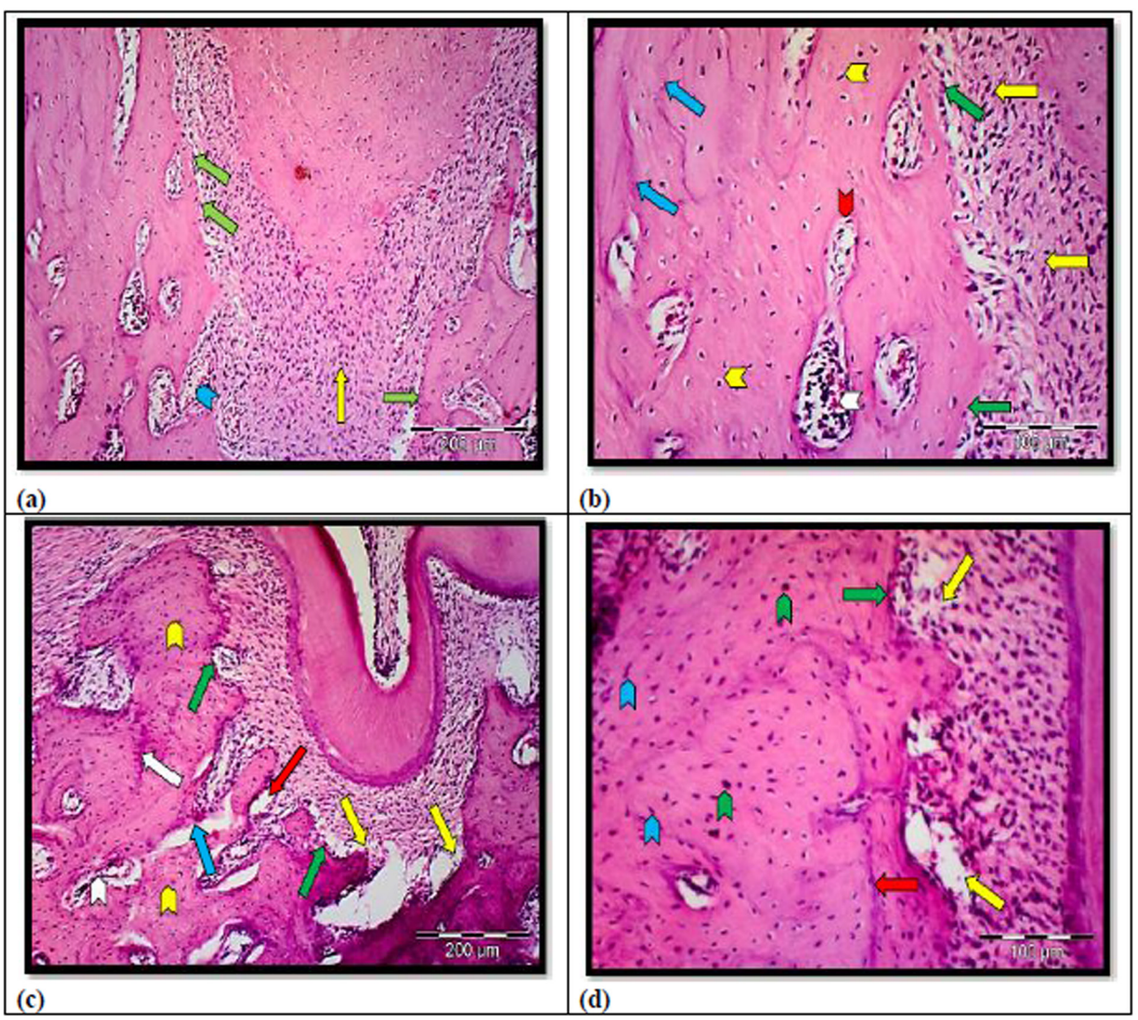

Fig. 1: Photomicrographs of alveolar bone showing: (a)-CG: well-organized PDL fibers (yellow arrows) surrounded by alveolar bone proper with a nearly regular outline and lined with osteoblasts (green arrows). Note the presence of Zuckerkandl and Hirschfeld canal (blue arrow head). (b)-CG: well-organized PDL fibers (yellow arrows), nearly regular socket wall lined by osteoblasts (green arrows). Numerous osteocytes inside lacunae (yellow arrow heads). Fibrocellular marrow cavities (white arrow head) lined by osteoblasts (red arrow head) and resting lines (blue arrows). (c)-IUG: degenerated areas in PDL fibers (yellow arrows). Relatively scalloped and irregular socket walls lined by osteoblasts (green arrows). Numerous osteocytes (yellow arrow heads). Fibrocellular marrow cavities (white arrow head) and reversal line (white arrow). Degenerated areas in alveolar bone (red arrow) and absence of osteoblastic lining (blue arrow). (d)-IUG: detached PDL fibers (yellow arrows). Some osteoblasts lining socket walls appeared flattened (green arrow). Numerous osteocytes of altered shapes, flattened lacunae (blue arrow heads), osteocytes with hyperchromatic nuclei (green arrow heads). Resting line (red arrow), (H&E, original magnification, a&cx100, b&dx200).

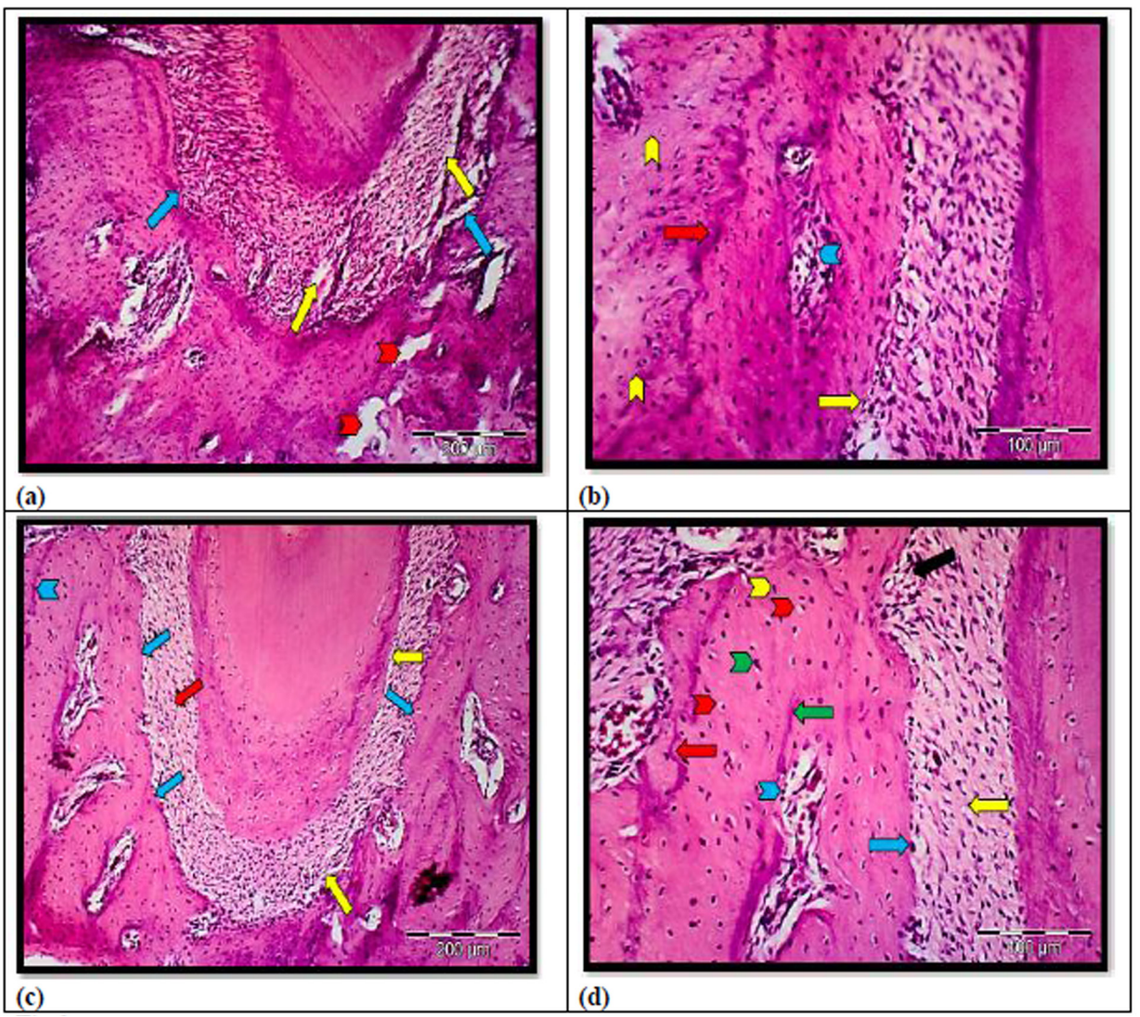

Fig. 2: Photomicrographs of alveolar bone showing: (a)-STG: some degenerated areas within PDL fibers (yellow arrows). A relatively irregular socket wall (blue arrow). Degeneration in some areas of alveolar bone (red arrow heads). (b)-STG: socket wall lined by osteoblasts with flat shape (yellow arrow). Numerous osteocytes (yellow arrow heads). Note the presence of fibrocellular marrow cavities lined by osteoblasts (blue arrow head). Reversal line (red arrow). (c)-GTG: well-organized PDL fibers (red arrow). Some areas with degenerated PDL fibers (yellow arrows). Irregular socket walls lined by osteoblasts (blue arrows). Reversal lines (blue arrow head). (d)-GTG: well organized PDL fibers (yellow arrow) and extravasated RBCS (black arrow). Socket walls lined by osteoblasts with hyperchromatic nucleus (blue arrow). Plump-shaped osteocytic lacunae (red arrow heads), flat osteocytic lacunae (yellow arrow head) and osteocytes with hyperchromatic nuclei (green arrow head). Note the fibrocellular marrow cavities lined by osteoblasts (blue arrow head). Resting lines (green arrow) and reversal lines (red arrow), (H&E, original magnification, a&cx100, b&dx200).

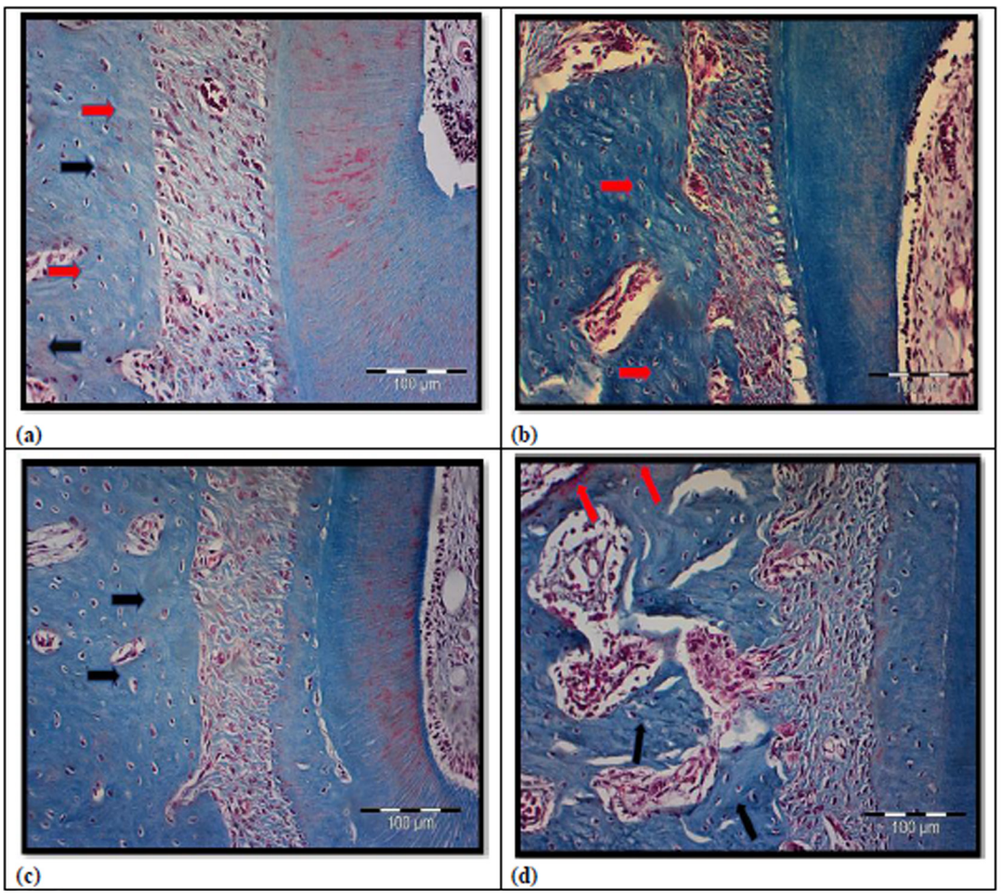

Fig. 3: Photomicrographs of alveolar bone showing: (a)-CG: well organized blue areas of immature collagen (red arrows) intermingled with fine red areas of mature collagen (black arrows). (b)-IUG: blue areas of immature collagen (red arrows). (c)-STG: blue areas of immature collagen (black arrows). (d)-GTG: disorganized blue areas of immature collagen (black arrows) and red areas of mature collagen (red arrows), (Masson trichrome, original magnification x200).

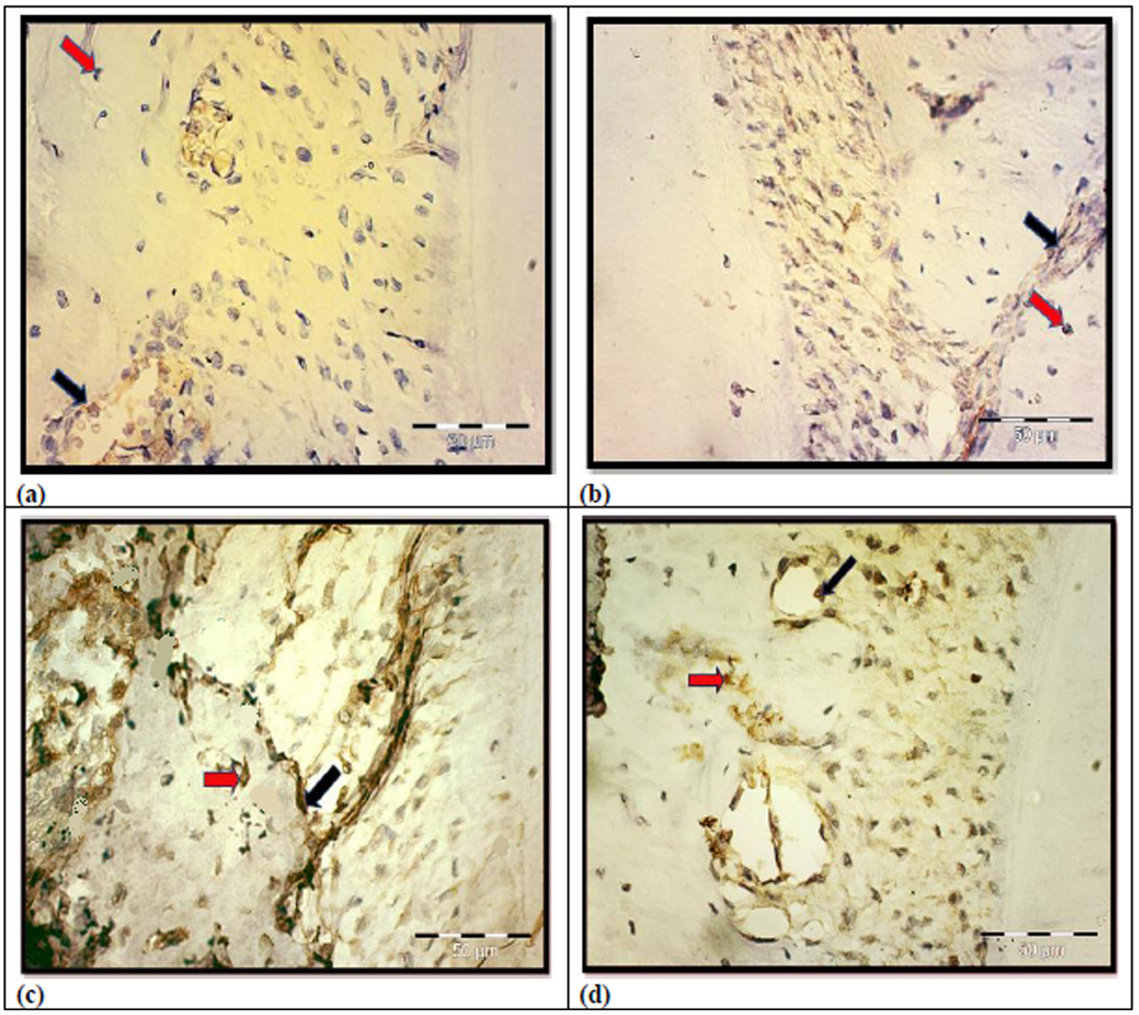

Fig. 4: Photomicrographs of alveolar bone showing: (a)-CG: mild positive reaction of osteoblasts (black arrow) and osteocytes (red arrow). (b)-IUG: mild positive reaction of osteoblasts (black arrow) and osteocytes (red arrow). (c)-STG: severe positive reaction of osteoblasts (black arrow) and osteocytes (red arrow). (d)-GTG: moderate positive reaction of osteoblasts (black arrow) and osteocytes (red arrow), (Anti-PCNA antibody, original magnification x400).

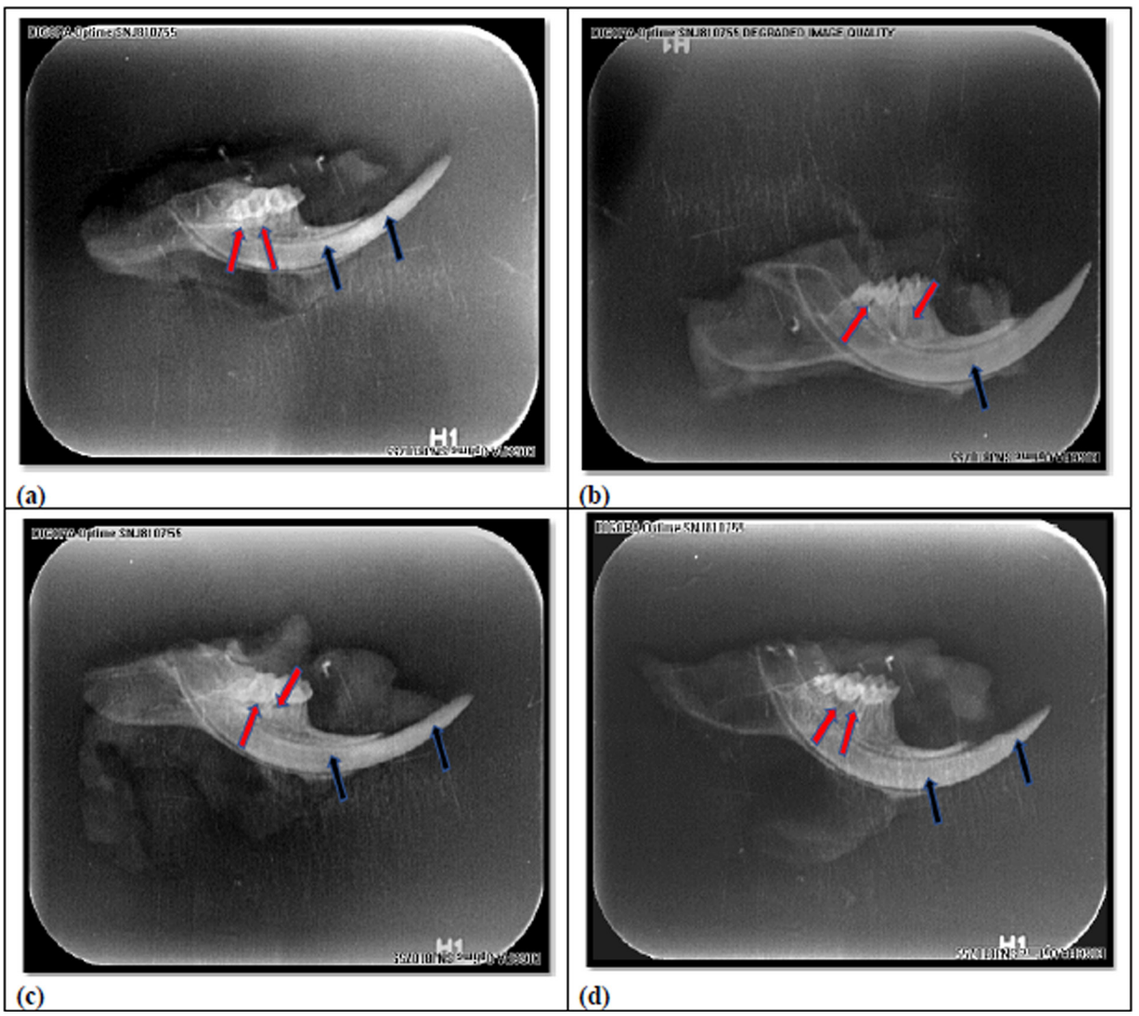

Fig. 5: Radiographic images of mandible showing: (a)-CG: uniform radiopaque areas of mandibular bone (black arrows). Radiopaque areas of alveolar bone surrounding mandibular molars roots (red arrows). (b)-IUG: nearly little radiolucent area in mandibular bone (black arrow). Apparently wide interproximal and interradicular areas with radiolucency of alveolar bone surrounding roots of molars (red arrows). (c)-STG: mandibular bone with uniform radiopacity (black arrows). Apparent radiopacity in interproximal areas of alveolar bone around mandibular molars roots (red arrows). (d)-GTG: mandibular bone with regular radiopacity (black arrows). Interproximal areas with radiolucency of alveolar bone around molars roots (red arrows).

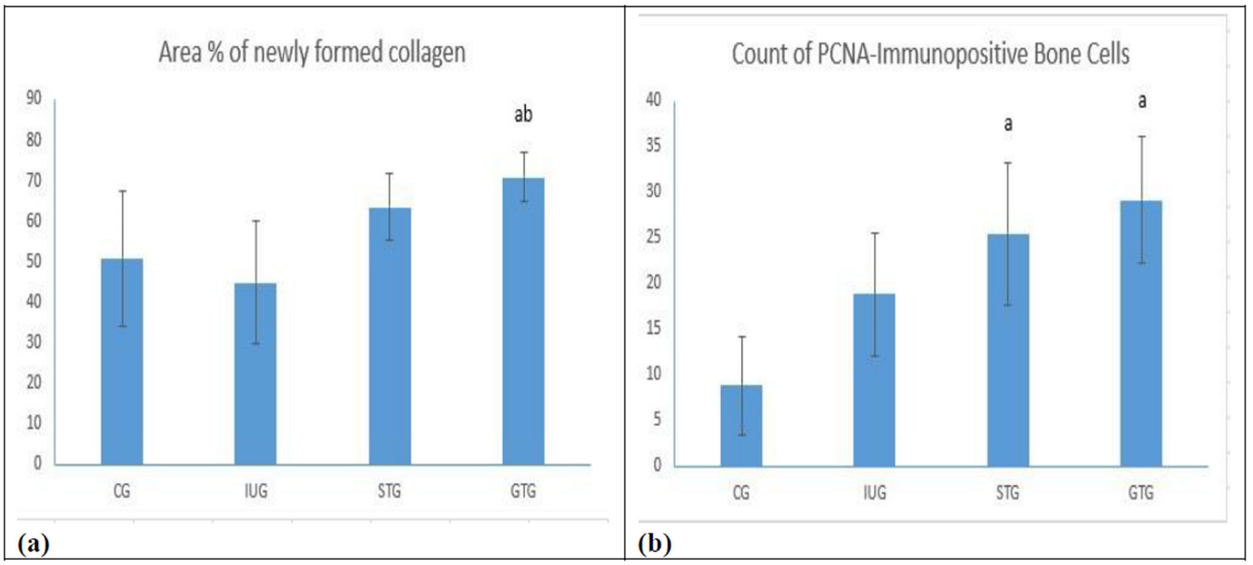

Fig. 6: Bar chart showing mean and SD values of (a)- area % of newly formed collagen (b)- count of PCNA immunopositive bone cells.

Table 1: showing the mean and standard deviation (SD) values of area % of newly formed collagen of all groups

Area (%)of Newly Formed collagen	CG	IUG	STG	GTG	ANOVA	*p-value*
Mean	50.82	44.79	63.53	70.88[ab]	6.081	0.001
±SD	16.83	15.1	8.3	6.24		

Significance at $P \leq 0.05$
a: statistically significant compared to corresponding value in CG ($P<0.05$)
b: statistically significant compared to corresponding value in IUG ($P<0.05$)

Table 2: showing the mean and standard deviation (SD) values of PCNA immunopositive bone cells count of all groups

Count of PCNA-Immunopositive Bone Cells	CG	IUG	STG	GTG	ANOVA	*p-value*
Mean	8.83	18.83	25.5[a]	29.17[a]	5.697	0.001
±SD	5.42	6.68	7.84	6.91		

Significance at $P \leq 0.05$
a: statistically significant compared to corresponding value in CG ($P<0.05$)

DISCUSSION

The rising levels of radiation exposure, specifically for medical treatments and its effect on bone architecture have a great concern[12].

Herbal medicine products are a natural alternative of radioprotectors which is important to manage pathological conditions caused by free radicals produced by ionizing radiations and overcome the toxic side effects of the use of synthetic products[4].

In this study, male albino rat was used as it is the most widely used animal in medical research and the most appropriate model of the human disease. In addition, the choice of male over female rats is due to the preferable avoidance of hormonal fluctuations associated with female reproductive cycle that may influence the study outcome[13].

Moreover, anti-PCNA antibody was used as immunohistochemical marker of the alveolar bone to evaluate cellular proliferation[14].

In the present study, H&E examination of alveolar bone in CG revealed well organized PDL fibers that appeared surrounded by alveolar bone proper with a regular outline and lined by osteoblasts. Numerous osteocytes and fibrocellular marrow cavities lined with osteoblasts as well as resting lines were seen. These findings come in line with the description of Nanci,[15].

In this study, H&E result of IUG showed areas of degeneration in PDL fibers. Sockets walls were apparently irregular and lined by osteoblasts. Osteocytes with flattened lacunae and hyperchromatic nuclei as well as resting and reversal lines were detected. These findings are in accordance with Makhlouf and Makhlouf,[16] who related these changes to damages of thiol proteins "membrane proteins" that affect the cellular structure, in addition to the elevation of acid phosphatase enzyme activity at the first week from irradiation.

In the present study, H&E result of STG showed improvement of alveolar bone in the form of more ordinary

socket wall with regular osteoblastic lining in comparison to IUG. This result could be attributed to polysaccharide extracts in spirulina which reduce DNA destruction of bone progenitor cells after radiation exposure. In addition, spirulina contains astaxanthin, a potent constituent that may reduce alveolar bone loss by enhancing osteoblastic activity and reducing osteoclastic action in an experimental periodontitis in rats[17,18], besides the antioxidant effect of spirulina against oxidative stress that induced by radiation[3].

In the present study, H&E result of GTG showed well organized PDL fibers with some areas of degeneration and relatively irregular socket walls in some areas. Numerous osteocytes lacunae, some of them showed plump shape while some appeared flattened. In addition, osteocytes with hyperchromatic nuclei, resting lines and reversal lines as well as some extravasated RBCs were observed. These results agree with Jagetia *et al*.,[4] and Jagetia *et al*.,[19] who reported that ginger protected mice from radiation- induced bone cells death. The authors attributed their results to antioxidant and free radical scavenging properties of ginger. Additionally, results of GTG of the current study could be related to the powerful stimulatory effect of ginger on the heart muscle of rats, that stimulates blood circulation throughout the body hence, it improves blood supply, activity of bone cells and consequently lead to new bone deposition[20].

In the herein study, Masson trichrome results along with statistical analysis of the CG showed low mean value of area% of newly formed collagen. This could be related to the balance between the percentage of mature and immature collagen in normal adult bone[21].

In the current study, IUG Masson trichrome and statistical analysis results revealed the lowest mean area% of newly formed collagen. This could be related to osteoblastic defects induced by gamma irradiation, which in turn decrease collagen synthesis[22].

In the present study, Masson trichrome results as well as statistical analysis of STG showed high mean value of area% of newly formed collagen. This result coincides with Gunes *et al*.,[23] who reported that the intake of spirulina increases the collagen content of rat bones by stimulating vitamin C metabolism, which is a co-factor for collagen synthesis against degradation.

In the herein study, GTG results of Masson trichrome and statistical analysis revealed high mean value of area% of newly formed collagen. This finding could be explained by Fan *et al*.,[24] who reported that 6-gingerol 'a major bioactive component of ginger' enhances collagen type I synthesis.

In the present study, immunohistochemical and statistical results of CG showed lower anti-PCNA antibody immunopositive bone cells (osteoblasts and osteocytes) than that of IUG. This could be linked to more release of growth factors in destructed tissues than normal ones, so it enhances cell proliferation and differentiation[25].

In the current study, STG immunohistochemical results and analysis of statistics revealed high count of anti-PCNA antibody immunopositive bone cells. This could be related to the stimulatory effect of spirulina on osteoblasts proliferation and differentiation[26].

In this study, GTG showed a statistically significant high count of anti-PCNA antibody immunopositive bone cells. This could be attributed to osteoblastic proliferation and maturation which increased in response to ginger treatment[24].

In the current study, radiographic image of CG showed radiopaque interproximal areas of alveolar bone of molars roots. This finding comes in agreement with Nakahara *et al*.,[27].

In the herein study, the radiographic results of IUG showed radiolucent interproximal and interradicular areas around roots of mandibular molars. This finding comes in parallel with Mallya and Tetradis,[28] who reported patchy radiolucent areas around roots of mandibular molars due to marked bone destruction caused by osteoradionecrosis.

In the present study, STG revealed radiopaque interproximal areas around roots of mandibular molars. This finding could be related to the binding of spirulina to toxic products as heavy metals and radioisotopes that released after irradiation leading to reduction of deleterious effect of radiation on bone[29].

Furthermore, this also agrees with the radiographic results of Rostiny *et al*.,[30] and Hassumi *et al*.,[31] who found that spirulina improves the process of alveolar bone healing by enhancement of mature bone formation and increasing bone volume. Moreover, Hwang *et al*.,[32] reported that the presence of astaxanthin increases bone formation, bone mineral density and microarchitecture by enhancing the osteoblastic activity.

In this study, the radiographic result of GTG showed interproximal radiolucent areas of alveolar bone surrounding the roots of molars. This result could be attributed to the recovery of alkaline phosphatase enzyme that requires three to four weeks to reach normal levels after irradiation[33].

CONCLUSIONS

Exposure to gamma radiation had destructive effects on alveolar bone histologically, immunohistochemically and radiographically. Spirulina and ginger have regenerative role against deleterious effects of irradiation. Statistically, ginger showed better radioprotective action against irradiation changes on alveolar bone in comparison to spirulina regarding to area% of newly formed collagen and bone cell count. However, spirulina presented better radiographic results.

CONFLICT OF INTERESTS

There are no conflicts of interest.

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الملخص العربى

تأثير السبيرولينا والزنجبيل ضد مخاطر الإشعاع على العظم السنخى للفك السفلي بالجرذان البيضاء (دراسة هستولوجية وهستوكيميائية مناعية وبالأشعة)

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الخلفية: أدى العلاج الإشعاعي إلى زيادة كبيرة في معدلات الشفاء للعديد من الأورام الخبيثة في منطقة الرأس والرقبة. تعتبرمنتجات الأدوية العشبية بديلاً طبيعيًا للحماية من الجذورالحرة الناتجة عن الإشعاعات المؤينة. يحتوي كل من السبيرولينا و الزنجبيل على مضادات للأكسدة التي تعطي حماية من مخاطر الإشعاع.
الهدف من البحث: يهدف البحث لدراسة التأثير المحتمل للسبيرولينا و الزنجبيل ضد مخاطر الإشعاع على العظم السنخي للفك السفلي بالجرذان البيضاء.
طرق البحث: تم تقسيم عشرين من الجرذان الذكور البيضاء الى اربع مجموعات رئيسية: المجموعة الظابطة: تكونت من خمس جرذان لم يتعرضوا للإشعاع و لم يتم معالجتهم. المجموعة المشععة غير المعالجة : تكونت من خمسة جرذان تعرضت للاشعاع فقط. المجموعة المعالجة بالسبيرولينا : بعد التعرض إلى الإشعاع اعطيت الجرذان جرعة من مستخلص السبيرولينا مرة يومياً لمدة اسبوع. المجموعة المعالجة بالزنجبيل: بعد التعرض الى الاشعاع اعطيت الجرذان جرعة من مستخلص الزنجبيل مرة يومياً لمدة اسبوع. استخرجت عينات من عظم الفك السفلى و حضرت وفحصت هستولوجيا وهستوكيميائيا مناعيا وبالتصوير الإشعاعي.
النتائج: اظهرت نتائج صبغة هيماتوكسلين والايوسين للمجموعة الظابطة انتظام بجدار العظم السنخي مع وجود الخلايا البانية للعظم. فيما اظهرت نتائج المجموعة المشععة غير المعالجة ضمور بالعظم السنخى و خطوط اعتكاسية. اظهرت نتائج كل من المجموعة المعالجة بالسبيرولينا و المجموعة المعالجة بالزنجبيل تجويف عظمي ذو جدار غير منتظم نسبيا و اماكن بها بعضا من الضمور داخل العظم السنخي. وظهرت نتائج صبغة ميسون ثلاثية الابعاد للمجموعة الظابطة و المجموعة المعالجة بالزنجبيل مناطق زرقاء اللون من الكولاجين المشكل حديثا مختلطا بمناطق اخرى حمراء اللون تمثل مناطق الكولاجين القديم. بينما اظهرت نتائج المجموعة المشععة غير المعالجة و المجموعة المعالجة بالسبيرولينا مناطق زرقاء اللون من الكولاجين المشكل حديثا. اما عن النتائج الهستوكيميائية المناعية, ففد اظهرت المجموعة الظابطة و المجموعة المشععة غير المعالجة وجود تفاعل مناعي ايجابي ذو قوة طفيفة. بينما وجد في المجموعة المعالجة بالسبيرولينا تفاعل مناعي ايجابي ذو قوة شديدة ووجد تفاعل مناعي ايجابي ذو قوة متوسطة في المجموعة المعالجة بالزنجبيل. اما عن نتائج التصوير الاشعاعي, فاظهرت نتائج المجموعة الظابطة والمجموعة المعالجة بالسبيرولينا مناطق منتظمة ظليلة للاشعة في العظم السنخي حول جذور اضراس الفك السفلي. بينما اظهرت نتائج المجموعة المشععة غير المعالجة و المجموعة المعالجة بالزنجبيل مناطق شفافة للاشعة.
الاستنتاج: التعرض للاشعاع يؤدي الي ضمور بالعظم السنخي. لدى السبيرولينا و الزنجبيل خصائص تجعلهم قادرين على حماية العظم السنخي من التأثيرات المؤذية الناتجة من التعرض للاشعاع. احصائيا اظهر الزنجبيل تأثيرا افضل للوقاية من الاشعاع على العظم السنخى مقارنة بالسبيرولينا.