The Role Of Selenium Nanoparticles In Reducing The Effect Of Hydrogen Peroxide On The Mammary Glands Of Female Albino Rats

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Abstract

The study was conducted to evaluate the role of selenium and nanoselenium in reducing the effect of hydrogen peroxide on mammary glands, and used 40 adult females and were randomly divided into four equal groups, the control group(C), Water was given only Treatment group (T1): Hydrogen peroxide was given 1% with drinking water Treatment group (T2): Hydrogen peroxide was given 1% with drinking water and nanoselenium was dosed at a dose of 0.5mg/kg of body weight. Treatment group (T3): Hydrogen peroxide was given 1% with drinking water and regular selenium was dosed at a dose of 0.5mg/kg of body weight. The results of the current study showed that hydrogen peroxide had a negative effect on the expression of the cells responsible for the receptors for the hormones progesterone and estrogen in the mammary glands of female rats, while the opposite was true in the groups that were dosed with regular selenium and nano-selenium, and the effect of nanoparticles was the most positive compared to other groups.

Key words: Selenium, Nano-Selenium, Estrogen, Progesterone

دور جزيئات السيلينيوم النانوية في تقليل تأثير بيروكسيد الهيدروجين على الغدد الثديية لإناث الجرذان البيضاء

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خلاصة

أجريت الدراسة لتقييم دور السيلينيوم والنانوسيلينيوم في تقليل تأثير بيروكسيد الهيدروجين على الغدد الثديية ، واستخدمت 40 أنثى بالغة وتم تقسيمها عشوائياً إلى أربع مجموعات متساوية ، المجموعة الضابطة (C) ، أعطيت المياه فقط مجموعة المعالجة :(T1) .أعطي بيروكسيد الهيدروجين 1٪ مع مجموعة المعالجة :(T2) أعطي بيروكسيد الهيدروجين 1٪ مع ماء الشرب وجرعات النانوسيلينيوم بجرعة 0.5 مجم / كجم من وزن الجسم. مجموعة العلاج :(T3) تم إعطاء بيروكسيد الهيدروجين 1٪ مع ماء الشرب وجرعة السيلينيوم العادي بجرعة 0.5 مجم / كجم من وزن الجسم. أظهرت نتائج الدراسة الحالية أن بيروكسيد الهيدروجين كان له تأثير سلبي على تعبير الخلايا المسؤولة عن مستقبلات هرموني البروجسترون والإستروجين في الغدد الثديية لإناث الجرذان ، بينما كان العكس صحيحًا في المجموعات التي تناولت جرعات. السيلينيوم العادي والسيلينيوم النانوي ، وتأثير الجسيمات النانوية كان الأكثر إيجابية مقارنة بالمجموعات الأخرى.

الكلمات المفتاحية: السيلينيوم ، النانو سيلينيوم ، الإستروجين ، البروجسترون

Introduction

Nanoparticles (NPs) are the submicroscopic particles ranging in size from 1 to 100 nm and having exotic properties such as small size, large surface area, surface chemistry, surface charge, multifunctionality, and solubility. They have played a large role in the drug delivery system, therapeutics, pathophysiology, and treatment privilege (Khurana et al., 2019). Selenium is present as selenocysteine in 25 human proteins and enzymes and plays a protective role in many pathological conditions, such as hypercholesterolemia, some types of cancer, and cardiovascular disorders (Bai et al., 2017). The biological activity of SeNPs depends on their size: the smaller the particles, the more important the activity (Torres et al.,2012). SeNPs are used as antimicrobial, antitumor (in vitro and in vivo), anticancer, and nutritional supplements (Yazdi et al.,2012). The health benefits of SeNPs are anti-aging, antioxidant, antidiabetic, strengthening immunity, reducing inflammation, improving fertility and brain function, anti-asthma, anti-arthritic, treating muscular dystrophy, antiviral, and regulating the thyroid gland, The synthesis and application of selenium nanoparticles (SeNPs) has gained increasing interest due to the number of benefits it offers, such as low toxicity, biocompatibility, and chemical stability (Zhang et al., 2001). Nowadays, SeNPs are widely used as a dietary supplement (Wang, Zhang & Yu, 2007). SeNPs have been found to exhibit lower cytotoxicity compared to inorganic selenium compounds, and have excellent anticancer and therapeutic properties. Zhang, Wang & Xu (2008) showed that SeNPs displayed novel antioxidant activities in vitro and in vivo using the activation of selenosomal enzymes.

Material and Methods

Experimental design

In this experiment, 40 rats, 90-day-old females, were used, and their weight ranged between (160 -170) g. They were randomly divided into 4 groups; each group includes 10 rats, as follows: **Control group (C):** Water was given only, **Treatment group (T1):** Hydrogen peroxide was given 1% with drinking water for 30 days, **Treatment group (T2)**: Hydrogen peroxide was given 1% with drinking water and nanoselenium was dosed at a dose of 0.5mg/kg of body weight for 30 days**, Treatment group (T3)**: Hydrogen peroxide was given 1% with drinking water and regular selenium was dosed at a dose of 0.5mg/kg of body weight.

Collection samples

All animals was sacrificed after 30 days of the experiment, as anesthesia was done using a mixture of 0.3 ml of ketamine and 0.1 ml of xylazine per kg of body weight intraperitoneal *i.p*, the mammary gland tissues extraction from all animals and kept in formalin 10 % to histological change and Immunohistochemistry study.

Results

Immunohistochemistry study

Progesterone receptors

The results of the current study of the immunohistochemistry of the hormone progesterone in the tissues of the mammary glands of female rats showed the intensity and strength of the positive immune reaction to the progesterone receptors, fig (1). The results of the current study of the immune reaction to study the immunohistochemistry of the hormone progesterone in the tissues of the lactic number of female rats showed a decrease in the intensity of the positive immune reaction and its strength for progesterone receptors in the group treated with hydrogen peroxide compared with the control group, as the strength of the positive interaction appeared to be very low in the group of hydrogen peroxide, Fig. (2, 3). The results of the current study of the immune reaction to study the immunohistochemistry of the hormone progesterone in the tissues of the milky digits of female rats showed the intensity of the positive immune reaction and its strength for the progesterone receptors, as the strength of the positive interaction appeared to be moderate to strong in the group treated with hydrogen peroxide with regular selenium compared with the group treated with hydrogen peroxide only and control group, Fig. (4). The results of the current study of the immune interaction to study the immunohistochemistry of the hormone progesterone in the tissues of the milky digits of female rats showed the intensity of the positive immune reaction and its strength for the progesterone receptors, as the strength of the positive interaction was strong in the group treated with hydrogen peroxide with nano-selenium compared with the group treated with hydrogen peroxide and regular selenium And the group treated with peroxide only and the control group, fig (5,6)

Estrogen receptors

The results of the current study of the immune reaction to study the immunohistochemistry of estrogen receptors in the tissues of the milky corpus of female rats showed the intensity of the positive immune reaction and its strength for estrogen receptors, as the strength of the positive interaction appeared to be normal in the control group, fig (7). The results of the current study of the immunological reaction to study the immunohistochemistry of estrogen receptors in the tissues of the milk number of female rats showed a decrease in the intensity

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Iraqi Journal of Humanitarian, Social and Scientific Research
Print ISSN 2710-0952 -Electronic ISSN 2790-1254

of the positive immune reaction and its strength for estrogen receptors in the group treated with hydrogen peroxide compared with the control group, as it appeared that the strength of the positive interaction was very little in the peroxide group Hydrogen, fig (8,9). The results of the current study of the immune reaction to study the immunohistochemistry of estrogen receptors in the tissues of the milky corpus of female rats showed the intensity of the positive immune reaction and its strength for estrogen receptors, as the strength of the positive interaction appeared to be moderate to strong in the group treated with hydrogen peroxide with regular selenium compared with the group treated with peroxide Hydrogen only and control group, Fig. (10,11). The results of the current study of the immune interaction to study the immunohistochemistry of estrogen receptors in the tissues of the milky corpus of female rats showed the intensity of the positive immune reaction and its strength for estrogen receptors, as the strength of the positive interaction was strong in the group treated with hydrogen peroxide with nano-selenium compared with the group treated with hydrogen peroxide and selenium The normal group, the peroxide-treated group only, and the control group, Fig. (12,13,14).

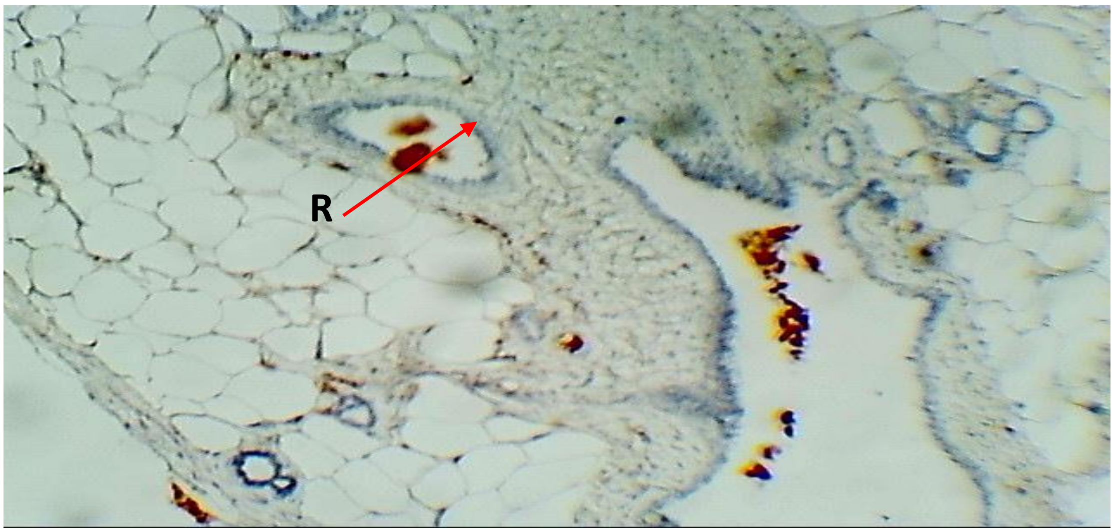

Figure (1): mammary gland of a rat from the control group that was dosed with water only for a month. A weak (R) interaction of progesterone receptors in cuboidal cells lining the milk ducts (40X DAB).

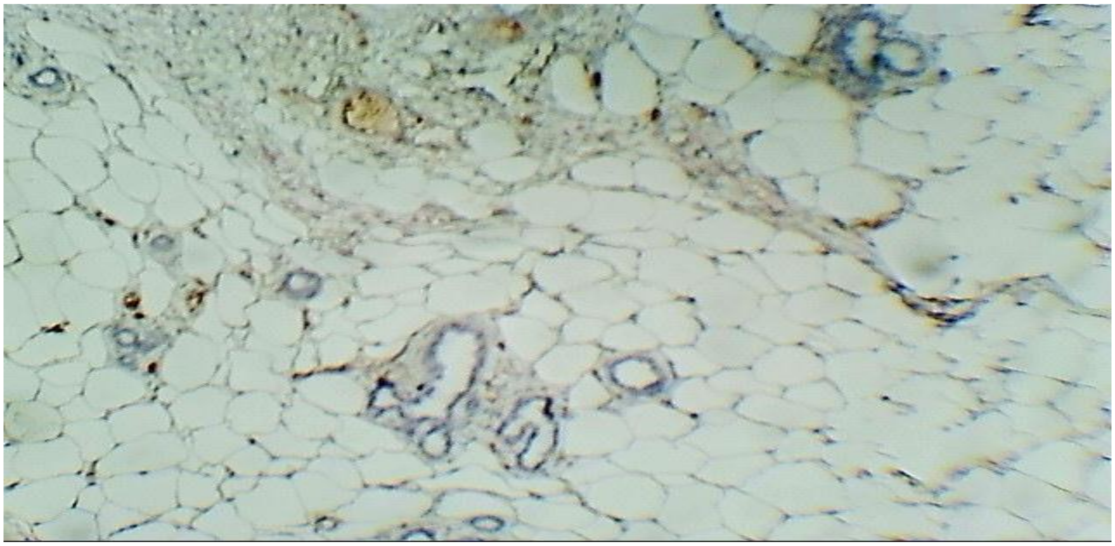

Figure (2): mammary gland of a rat from the control group that was dosed with water only for a month. Poor reactivity (R) of progesterone receptors in cuboidal cells lining the milk ducts (40X DAB).

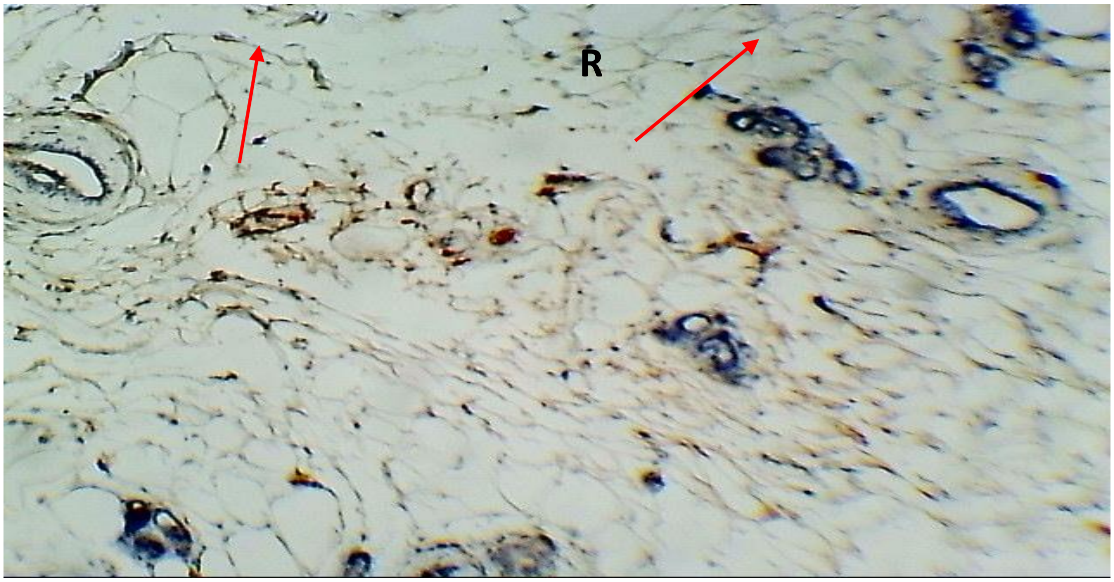

Figure (3): A rat's mammary gland from hydrogen peroxide group 1% only for a month. The intensity of the immune reaction was weak to the progesterone receptors in the cuboidal cells lining the milk ducts (R) (40X DAB).

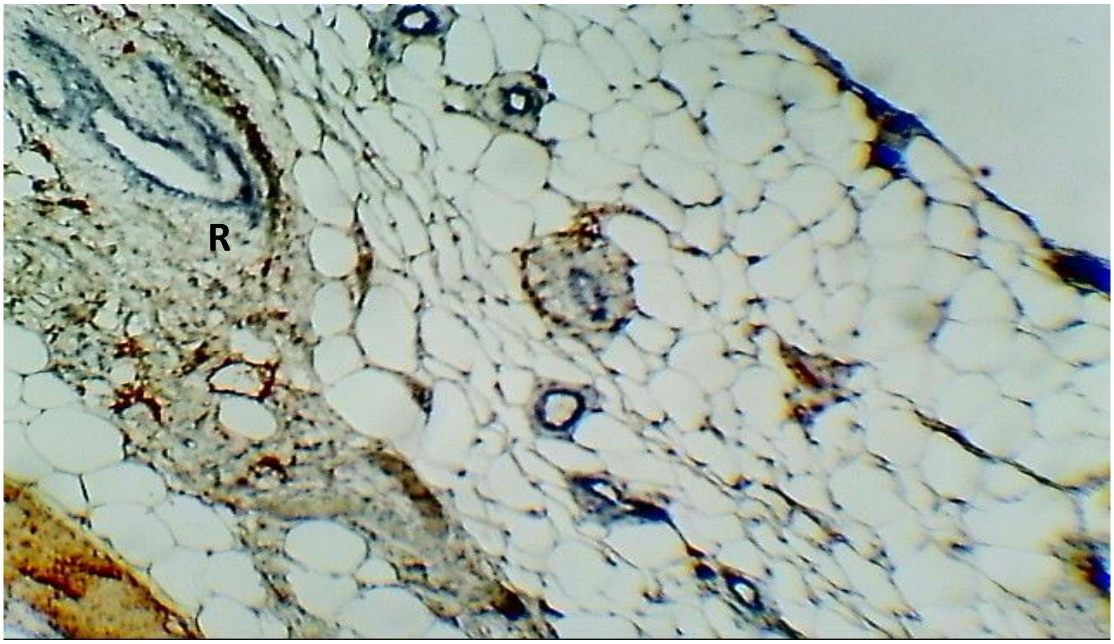

Figure (4): A mammary gland of a rat from the hydrogen peroxide group 1% with selenium 0.5 mg/kg of body weight for a month. Strong immune reaction intensity (R) for progesterone receptors in cuboidal cells lining the milk ducts (40X DAB).

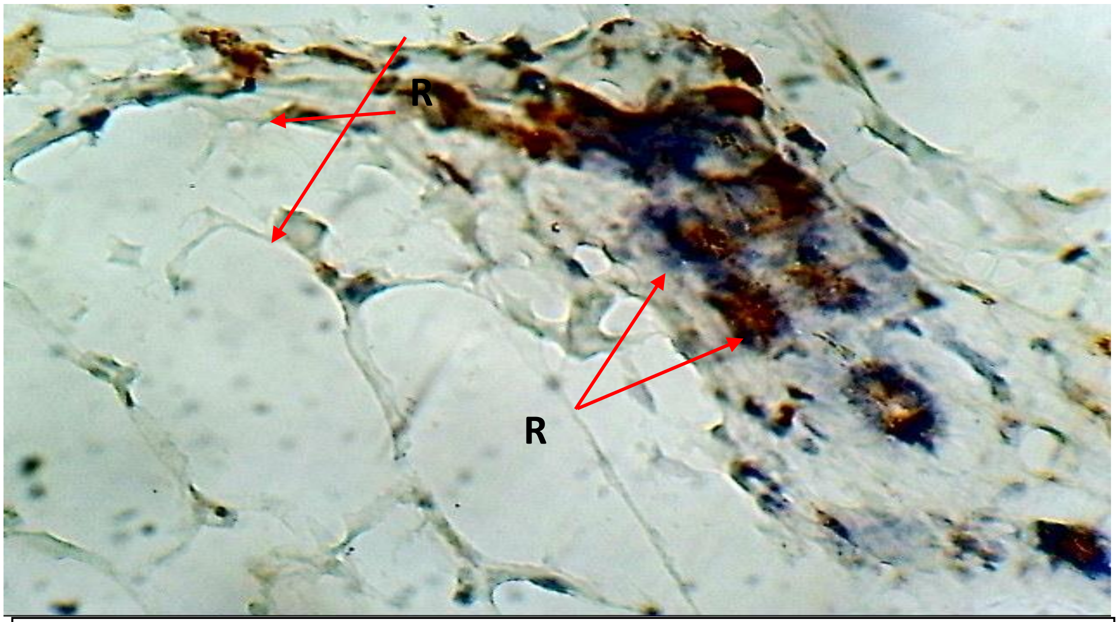

Figure (5): A rat's mammary gland from hydrogen peroxide 1% with nano-selenium 0.5 mg/kg of body weight for a month. Strong immune reaction intensity (R) for progesterone receptors in cuboidal cells lining the milk ducts (40X DAB).

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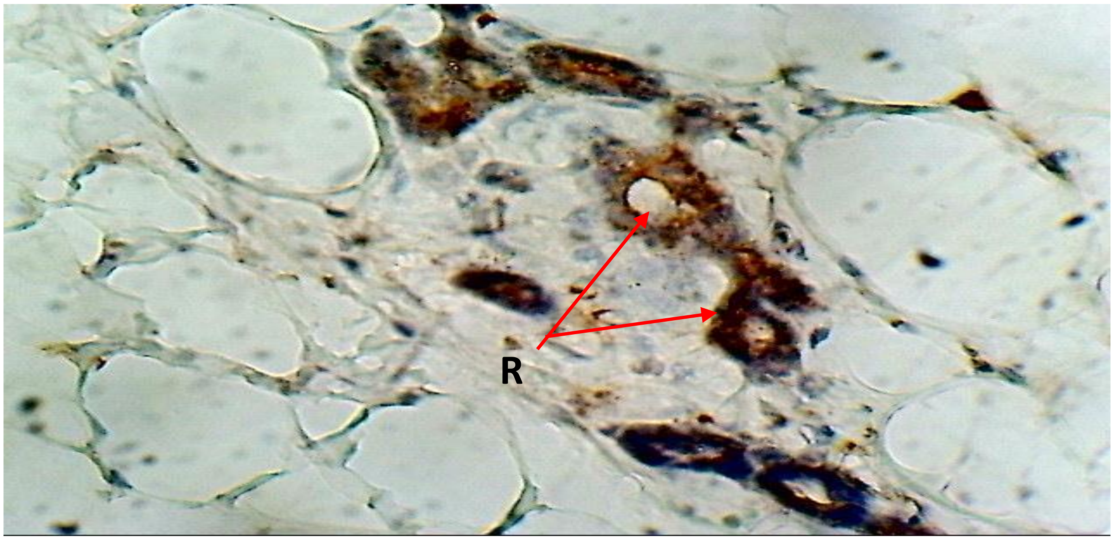

Figure (6): A rat's mammary gland from a group of 1% hydrogen peroxide with nano-selenium 0.5 mg/kg of body weight for a month. Strong immune reaction intensity (R) for progesterone receptors in cuboidal cells lining the milk ducts (40X DAB).

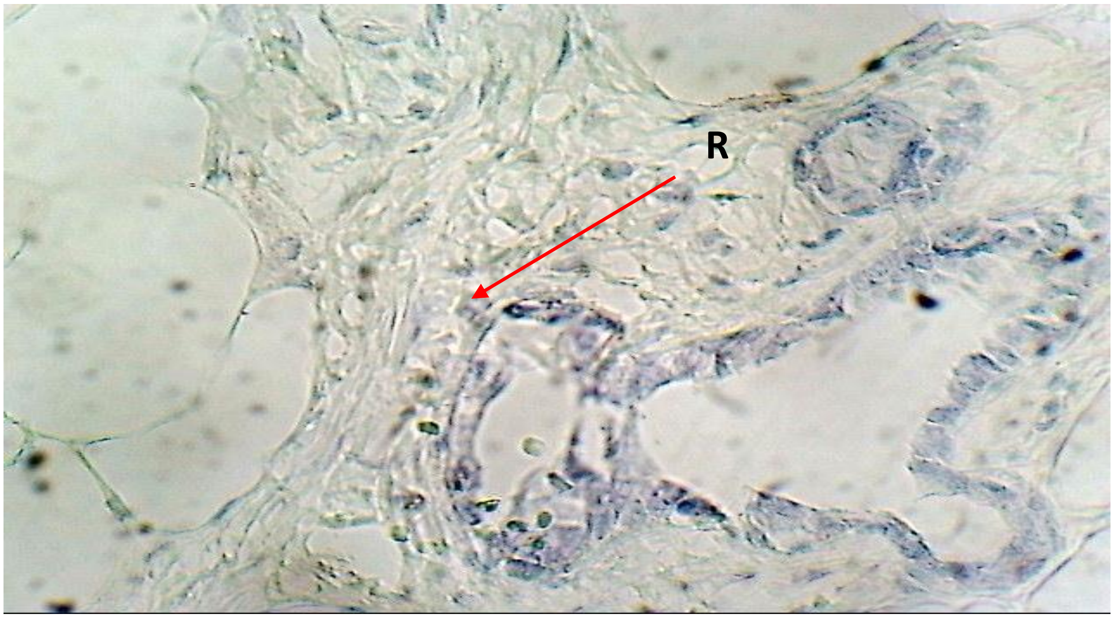

Figure (7): mammary gland of a rat from the control group that was dosed with water only for a month. Weak (R) inhibition of estrogen receptors in cuboidal cells lining the milk ducts (40X DAB).

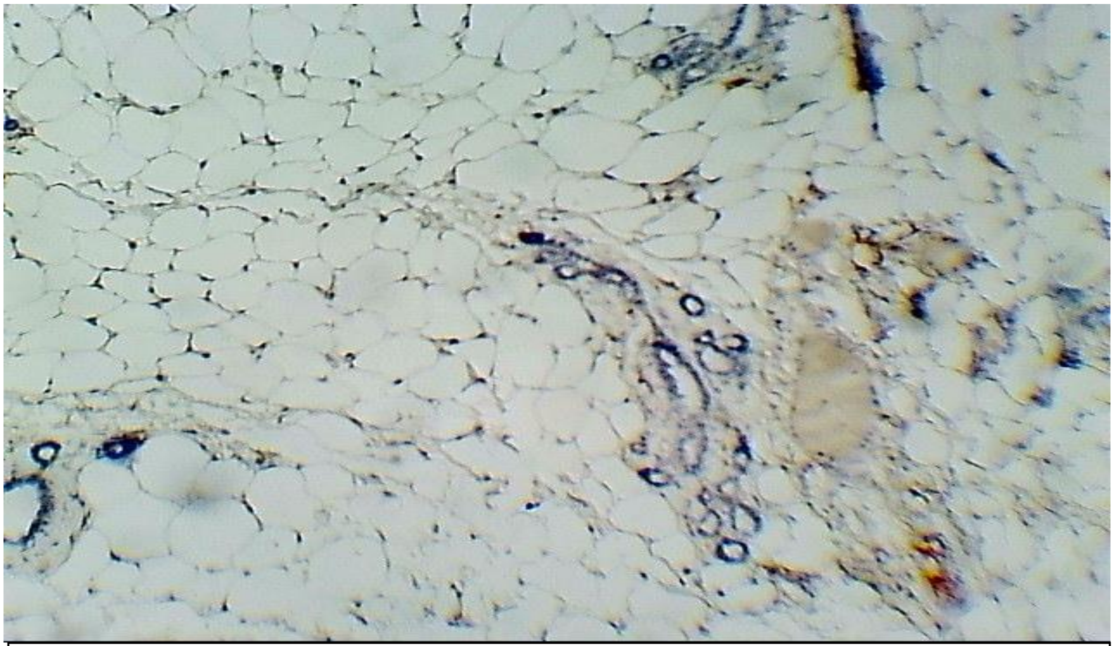

Figure (8): A mammary gland of a rat that received 1% hydrogen peroxide only for a month. The intensity of the weak immune reaction to the estrogen receptor (R) in the cuboidal cells lining the milk ducts (40X DAB).

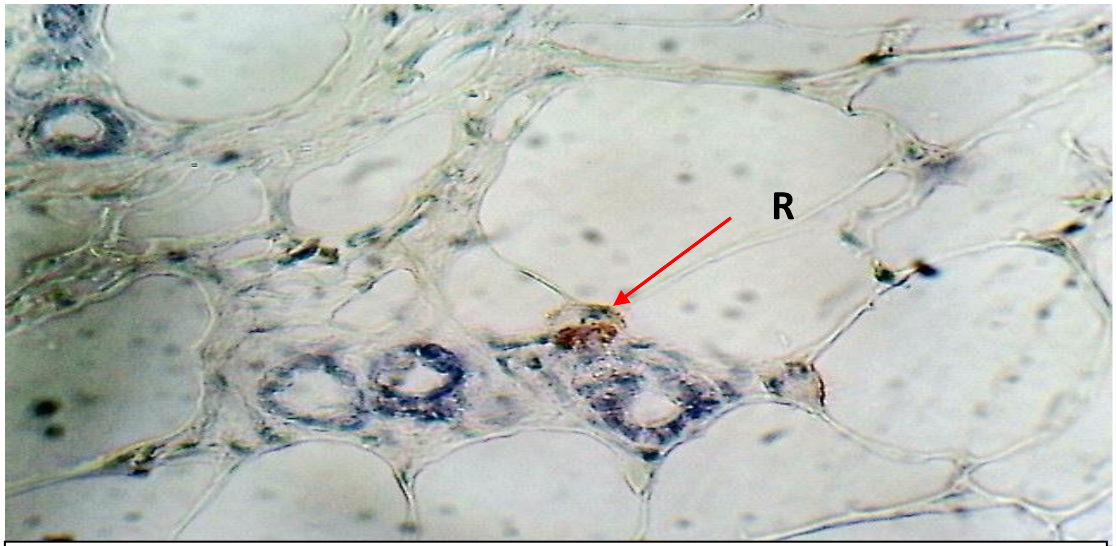

Figure (9): A mammary gland of a rat that received 1% hydrogen peroxide only for a month. Weak reaction intensity (R) to estrogen receptors in cuboidal cells lining the milk ducts (40X DAB).

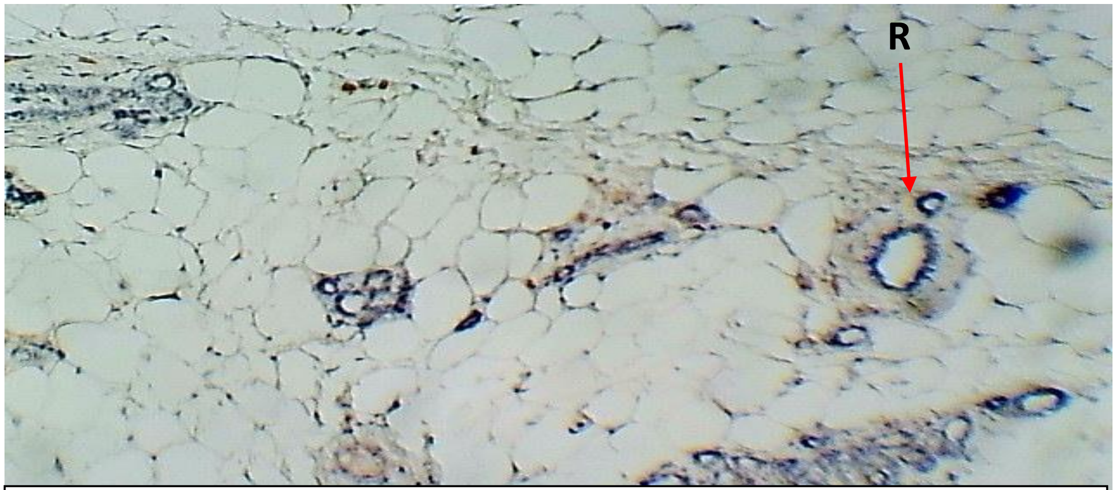

Figure (10): A mammary gland of a rat from a group of hydrogen peroxide 1% with selenium 0.5 mg / kg of body weight for a month. Strong immune reaction intensity (R) for estrogen receptors in cuboidal cells lining the milk ducts (40X DAB).

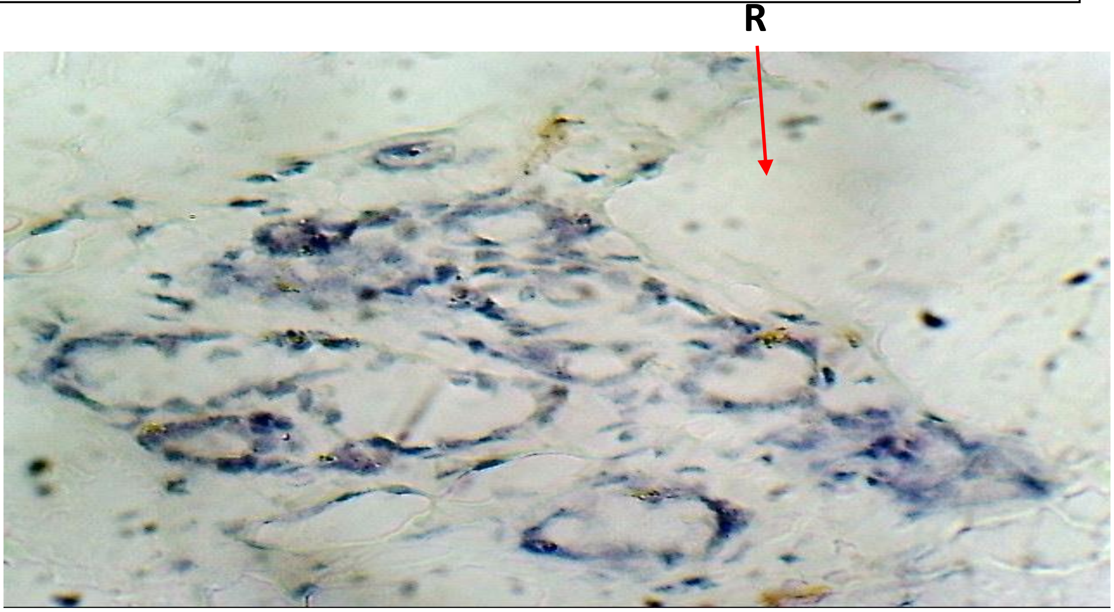

Figure (11): The mammary gland of a rat from the hydrogen peroxide group 1% with selenium 0.5 mg / kg of body weight for a month. Strong immune reaction intensity (R) for estrogen receptors in cuboidal cells lining the milk ducts (40X DAB).

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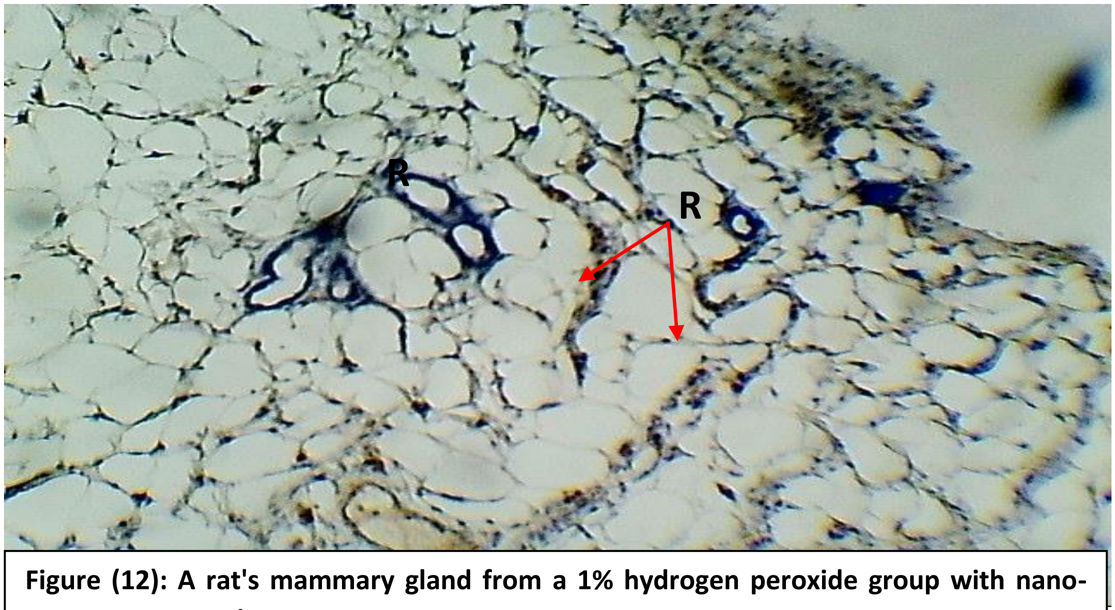

Figure (12): A rat's mammary gland from a 1% hydrogen peroxide group with nano-selenium 0.5 mg/kg of body weight for a month. The intensity of the strong immune reaction to estrogen receptors in cuboidal cells lining the milk ducts (R) (40X DAB).

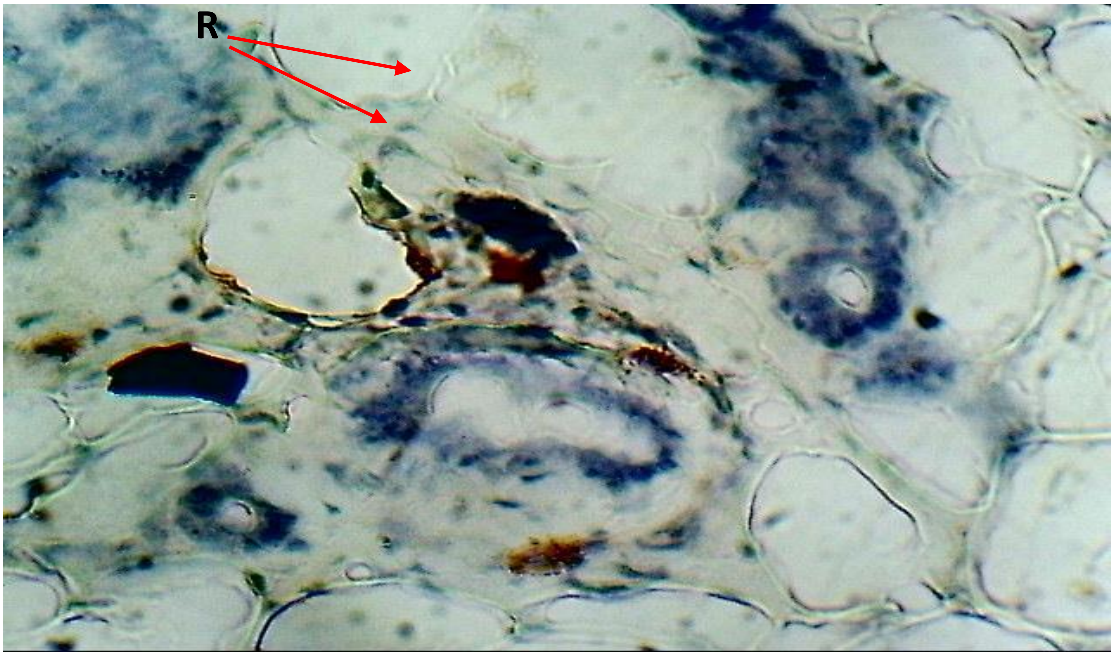

Figure (13): The mammary gland of a rat from the hydrogen peroxide group 1% with selenium 0.5 mg / kg of body weight for a month. Strong immune reaction intensity (R) for estrogen receptors in cuboidal cells lining the milk ducts (40X DAB).

Discussion

and estrogen works through it. There is an ERα receptor in the mammary gland. ERα is essential for luminal epithelium proliferation, differentiation, and survival during pregnancy and lactation in addition to the pupal stage (Nowfel and Al-Okaily, 2017). Moreover, the receptors for estrogen are progesterone receptors and cyclin D1. The progesterone receptor is required for epithelial differentiation and morphogensis, while cyclin D1 is regulated by the progesterone receptor and has a positive feedback on ERα transcriptional activity in mammary gland development. It is known that progesterone acts simultaneously with prolactin in promoting the development of the lobular-alveolar system in the mammary glands (Yavari et al., 2016). Selenium plays an important role as an antioxidant and protects the body from the effects of some toxic elements and their accumulation in the body (Radostits et al., 1999; Pavlik et al., 2012). The important effect of selenium is attributed to the presence of many enzymes that selenium enters into its composition, but the most important of which is the enzyme glutathione peroxidase, which is present in the cytoplasm of cells. This enzyme has an important role in regulating the level of hydrogen peroxide H2O2 by converting reduced glutathione to oxidized glutathione (Arthur, 2000). Thus, it works to protect cells and tissues against lipid peroxidation by removing hydrogen peroxide and then reducing the formation of hydroxyl radicals (Arteel & Sies, 2001). Adding selenium to the diet of rats protects them from oxidative damage (Chen & Tappel, 1993).

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Mohammed Salih Alwan1 and Baraa Najim Al-Okialy 2019 Effect of alpha Lipoic Acid on Some Reproductive Hormones in Adult Male Wister Rats Exposed to Hydrogen Peroxide Kufa Journal For Veterinary Medical Sciences Vol. (10) No. (1) 2019.

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