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Gamma Ray Radiation Effects Emitted from Am-241 on Some Physiological Cases of Adult Rats

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Abstract

The aims of the present work are to find the effect of gamma rays radiation at three doses in m Gy/h as radiation doses rate for 55 days at 7h/day irradiation on sex ratio of male and female rats. A significant decrease was noticed ($p< 0.05$) in the sum number of offspring, the number of male sex and male sex ratio when exposed to the doses from 0.06-0.4 m Gy/h and compared with control group. This decrease is proportional to the increase of doses gradually. Another point, the gamma ray radiations with mentioned doses rate and also with the same mating showed significant increases ($p< 0.05$) in the female offspring's number and their sex ratio%. This increase is proportional to the increase of doses automatically. This paper also showed significant change in male and female rats sex ratio. The offspring female ratio % exposed to gamma ray was more than of the ratio% of offspring male rats compared with control, so during gestations, an exposure from any source with a frequency more than GHz .and wave length in (10-10 meter) must be avoided.

Keywords: Sex Ratio; Mating; Gamma Ray Radiation; Male and Female Adult Rats; Offspring.

Introduction

Many types of ionizing radiation diffused to potent genetic and cytotoxic changes in evolution mutation yield (by ionizing radiation) is transferred into two types such as somatic cell mutations [1-2] and germ cell mutations [3-5]. The radio sensitivity of rat embryo fluctuated [6] by a factor of 3-4 between days 3 and 10 of development .The magnitude of the fluctuation was virtually identical in animals exposed to gamma rays or helium ions, and the RBE of the latter with respect to embryo killing averaged 1.0 during this period of development .As knowledge genetics progressed [7] reconsidered this theory, their most recent postulate being that while maternal exposure would, in principle reduce the sex ratio it is difficult to predict what the effect irradiation of fathers might have since, with the recognition that one X chromosome is inactive in the somatic cell of women ,it became clear that sex linked mutations induced in males were unlikely to have a dominant lethal effect in female [8].

A high sex ratio of offspring born to men exposed to ionizing radiation at Sella field [9] where the sex ratio of offspring born to their most heavily irradiated men,201 sons, 144 daughters) is highly significant and it is different from that of the offspring of women who had received preconceptual radiation (454 sons, 461 daughter).and also the data of Dickinson do add to already existing strong evidence that ionizing radiation induces sex linked lethal mutations in man which are

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reflected in the offspring sex ratios of irradiated parents. Another's study [10] found 1100 survivors of childhood cancer became the parents of 2130 children, the sex ratio for male due to female cancer was similar and did not differ significantly from the Danish population. Radiotherapy did not influence the sex ratio of the children of either male or female survivors and there was no evidence for dose- related changes over categories of the estimated dose to parental gonads. The mutations can be agreed in humans and all types of animals by using methods that show mutagenic effects at many levels, involving the tissues.

The structure of these helps firstly in expecting genotoxicity at the original point and then leading to the risk in the total population referring to monitoring of Geno toxicity and second states as mutagenicity took place by using chromosome aberration study in somatic cells [11].

The sex ratio of the offspring is famous as a ratio of the male or female per the ratio of the total offspring, leading to a potential significance of reproductive risk in paternal subjects [12-13]. Irradiation with changing forms of radiation source and toxic material including and not limited to electromagnetic radiation [14-17] and the pollutants of environmental refer to the dioxins [18-20]. Proportion offspring scientifically increase and also has been observed among male radiologists and male surgeons irradiated with ionizing radiation [21-22]. The effect on the potential hormonal profile with its change and damage due to Y chromosomal leading to effect on the other potential. Mechanisms for this effect and change in sex ratio. Other studies have shown that ionizing radiation nonmedical field may not affect the sex ratio [25-27]. More complex generation, technically complicated methods, it is now suggested that cardiologists performing fluoroscopic – guided methods are performing irradiation with towering level of ionizing radiation among those using x-ray technology [28-30]. Determining interventional collar level exposure in the range between 0.04 to 0,16 m Sv per methods, and middle level exposure less than 0.05 mm lead apron has ranged from 0.01 to 0,02 m Sv/case [31-33].

The interventional methods that expose operators to upper levels of ionizing radiation than Low dose rate of gamma radiation was reported from many researchers as [34] who used soft gamma ray radiation in m Gray on the reproductive system in the earthworm Eisenia fetida (oligocheta) by using chronic gamma radiation and found that ability of reproduction reduce with increased dose rate gradually. The study of [35] which was found that the continuous exposure to electromagnetic field with low frequencies lead to Apoptosis for germ cell of testis in Muss musculus mice from Balb/c while no important effect appears on body weight and weight of testicular but showing an increase in death of germ cell for testis. The results that are referred to take place Apoptosis in spermatocytes.

Finally, the study of [36] found the paternal or prenatal LDIR/LDRIR exposure is associated with reduced fertility and number of live fetuses, and Tran generational genomic aberrations. On the other hand, in some experimental studies, LDIR/LDRIR exposure has also been reported to bring about beneficial effects such as reduction in tumorigensis, prolonged Lifespan and enhanced fertility. The difference in reported effects of LDIR/LDRIR exposure is dependent on animal genetic background (susceptibility), age (prenatal or postnatal days), sex, nature of radiation exposure, type of radiation, a combination of radiation with other toxic agents or animal experimental designs. The chosen of dose of gamma ray in mili Gray agree with [37] which was used the same radioactive source ,animals and the same level of dose rate 6 m Gy/h for 7h/day for 25 and 50 days as irradiation dose rate affected on the hematological parameter of adult rats as well as [38] were employed the same case from dose rate level , animals and ionizing radiation (gamma ray) influences on reproductive system of rats specially characteristic of sperm cell and behavior .This work identical with using m Gy /h with [39] whose were irradiated adult male mice with 110 m Gy/h and 310 to find biological impact of white blood cell . Another type of animals as male chickens also has been irradiated with gamma ray with m Gray /h as dose rate to find the biophysical effect of gamma ray on some parameters of blood [40].

The aims of the present work are to find the effect of gamma rays radiation at three doses in m Gy/h as radiation doses rate for 55 days at 7h/day irradiation on sex ratio of male and female Wistar rats. The use of a low dose rate to irradiate rats for a long period of time is very important to study the effect of this on the physiological behavior of animals when mating, as there is the possibility of physiological changes affecting the nature and gender of the newborn, and this is very important as an application to people who receive this dose on a daily basis for a long period as bad environmental effects or in the field of work in radioactive materials stores and nuclear reactors. On the other hand, it could also affect economically if the application of this study was on economic animals such as sheep, cows, horses, camels and goats

Materials and Methods

Rats were used. Which range from 2-3 months of age

to 170- 200 gm of weight. Good rats were collected from the University of Mosul veterinary college. They were housed in plastic cages fitted with metal lids (dimensions 20x30x30 cm), while measures were taken to ensure good hygiene. The experiment was maintained at 26oC ±2 and 35% ± 5% respectively, while the sawdust mixture was adjusted every week. They also got water during the experiment [41].

Work System

Am -241 gamma ray source with activity 1μCi and half-life 412 year, with different absorbed doses and has energy with 59.5 keV . The source was put about a few centimeters from rats' cages in any dose received by rats in any experiment. The choosing irradiation period of 55 days with a weak dose rate in mili Gray return to the same dose rate and exposure time were taken in many studies in the similar to this object, rather than, these parameters close to the dose rate of annual back ground as well as the dose rate near the stores of radioactive materials.

Experimental design:

Forty rats were used in the experiment, they were divided into groups and given the needed doses as follows:

1- First group (control) includes 10 rats not exposed to the gamma ray (control) which included (1) female and (1) male rat in every cage from (5) cages of mice as well as in all groups.

2- The second group includes 10 rats, they were exposed to 0.06 m Gy/h.

3- Third group includes 10 rats and exposed to 0.1 m Gy.h

4- Fourth group includes 10 rats exposed to 0.4 m Gy/h

5- In Groups (2-4), the number of male rats is 15 used for 55 days at a rate of 7 hours daily.

This work achievement in University of Mosul/ College of Science Biophysics Department and also physics Department. In 3 march 2018 was registered in the physics department with in physics Department's annual research plan.

Statistical analysis

The analysis of variance was used in this experiment. Differences were determined by Duncabs multiple range test in all measurements. At ($p \leq 0.05$) percent level (Steel. and Torrie,1980) [42] by using SAS

Results

The results were reported in Table 1 which represent the effect of gamma ray radiation at 0.06,0.1 and 0.4 mGy/h for 55 days with 7 h/day on some physiological parameters.

An effect of gamma ray radiation at 0.06, 0.1 and 0.4 m Gy/h dose rates with 7h/day for 55 days at gamma ray irradiation daily on mating to (exposed male x normal female):

Sum number of offspring

The impact of gamma ray radiation at 0.06,0.1 andd 0.4 m Gy/h radiation doses for 55 days at 7h/day irradiation on mating to (exposed male x normal female). A significant decrease was noticed ($p< 0.05$) in the sum number of offspring when exposed to 0.06 ,0.1 and 0.4 m Gy/h compared with the control group. This decrease is proportional to the increase of doses as in the Figure 1.

Male offspring number

The impact of gamma ray radiation at 0.06,0.1 and 0.4 m Gy/h radiation doses for 55 days at 7 h/day irradiation daily on mating to (exposed male x normal female). A significant decrease was noticed ($p< 0.05$) in the male offspring number when exposed to 0.06, 0.1 and 0.4 m Gy/h compared with the control group. This decrease is proportional to the increase of doses as in the Figure 2.

Female offspring number

The impact of gamma ray radiation at 0.06,0.1 and 0.4 m Gy/h doses for 55 days at 7/day mating to (exposed male x normal female). A significant increase

Table 1. The effect of gamma ray doses 0.06, 0.1 and 0.4 m Gy/h as dose rates for 55 days with 7h/day irradiation on some physiological parameters.

Groups	Measurements				
	Female Sex ratio %	Male Sex ratio %	Offspring no. of female sex	Offspring no. of male sex	Sum number of offspring
Control	54.716 c± 1.208	45.284 a± 1.121	5.8 c±1.011	4.8 a±0.721	10.6 a±0.911
0.06 mGy/h	61.703c±0.289	38.297 b± 0.311	5.8 c± 0.299	3.6 b±0.3.23	9.4 b±0.121
0.1 mGy/h	76.108 b±0.411	23.892 c±0.398	7 b±0.334	2.2c±0.434	9.2 c± 0.332
0.4 mGy/h	84.330a± 0.878	15.670d±0.655	7.4 a±0.678	1.4 d±0.822	8.8 d± 0.632

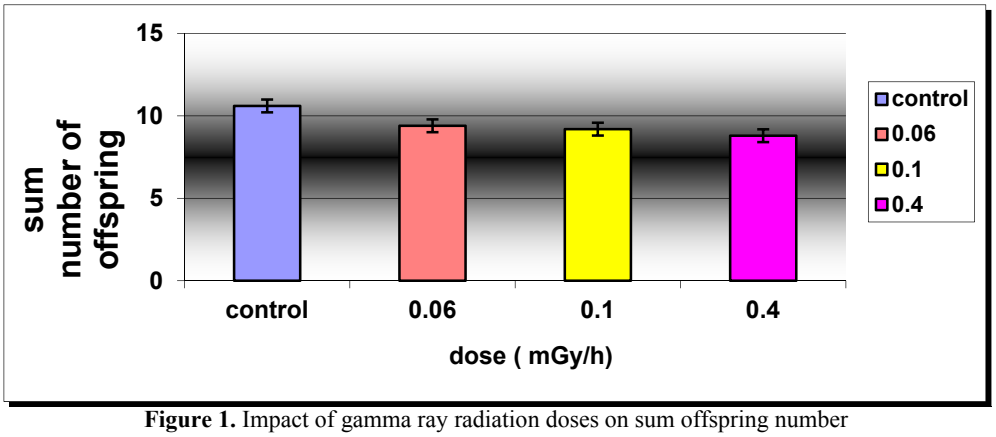


Figure 1. Impact of gamma ray radiation doses on sum offspring number

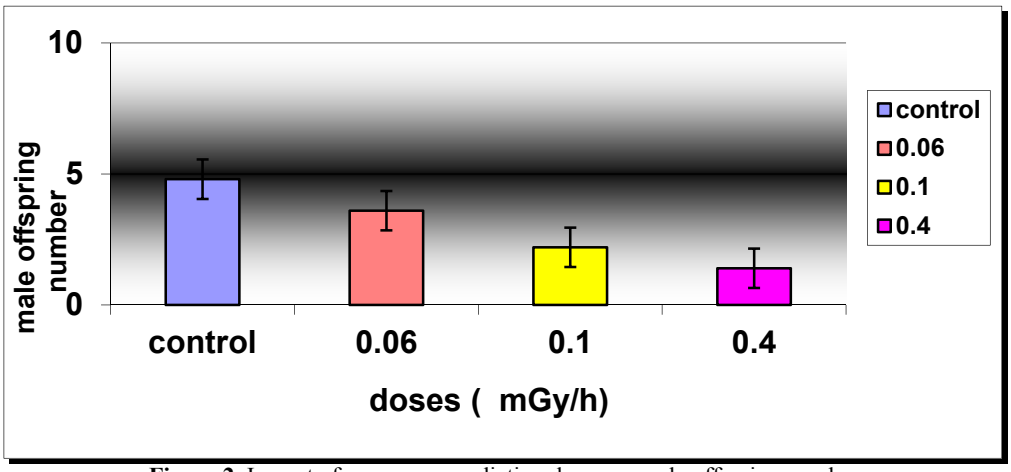


Figure 2. Impact of gamma ray radiation doses on male offspring number

was noticed ($p < 0.05$) in the number of female offspring when exposed to 0.06,0.1 and 0.4 m Gy/h compared with the control group. This increase is proportional to the increase of doses as in the Figure 3.

Male offspring -sex ratio %

The impact of gamma ray radiation at 0.06,0.1 and 0.4 m Gy/h doses for 55 days at 7 hours daily on mating to (exposed male x normal female). A significant decrease was noticed ($p < 0.05$) in the Male offspring

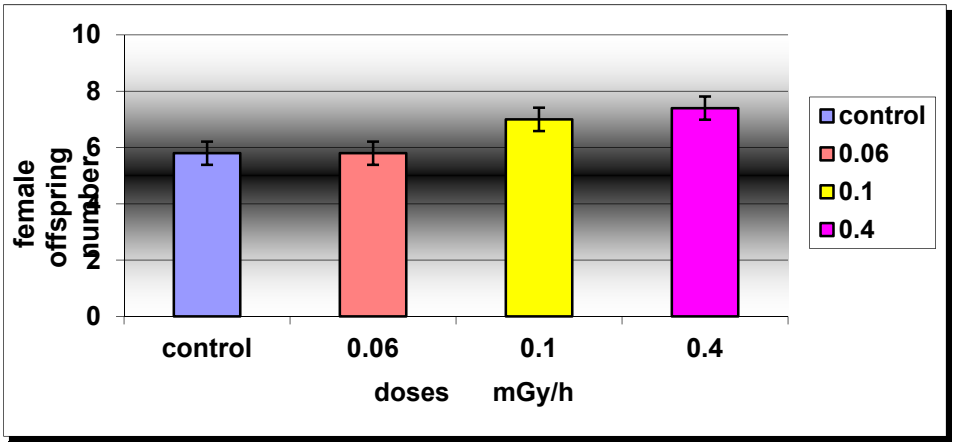


Figure 3. Impact of gamma ray radiation doses on female offspring number

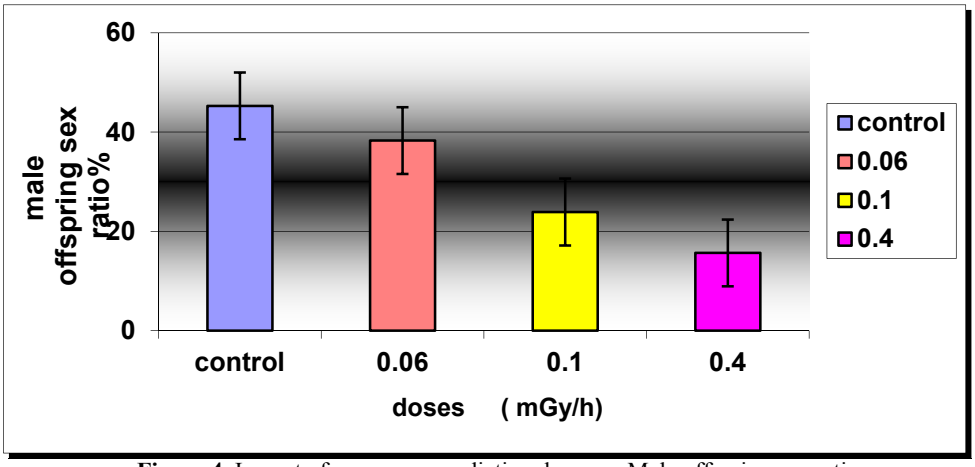
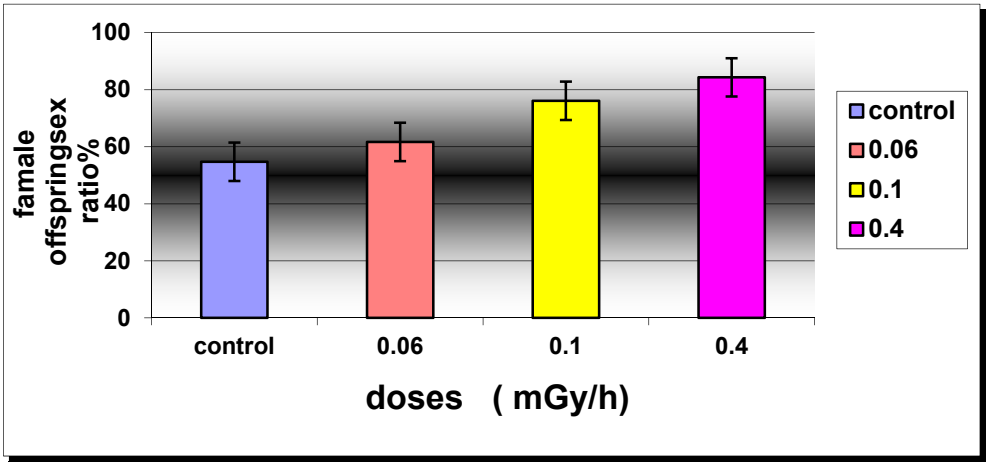


Figure 4. Impact of gamma ray radiation doses on Male offspring sex ratio



Figures 5. Effect of gamma ray radiation doses on female offspring sex ratio

sex ratio% when exposed to 0.06,0.1 and 0.4 m Gy/h compared with the control group. This decrease is proportional to the increase of doses as in the Figure 4.

Female offspring sex ratio %

The effect of gamma ray radiation at 0.06,0.1 and 0.4 m Gy/h doses for 55 days at 7 hours daily on mating to (exposed male x normal female). A significant increase was noticed ($p< 0.05$) in the Female offspring sex ratio % when exposed to 0.06,0.1 and 0.4 m Gy/h compared with the control group. This increase is proportional to the increase of doses as in the Figure 5.

The figures from (1-5) are represented in the following information:

- Values expressed by average ± experimental error
- The different letters on each rectangular means significant differences at less than 0.05 % level.
- Number of animals is10 per each group
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Discussion

From figure (1) we found decrease in the number of sum offspring of rats which were exposed to gamma ray radiation doses and so as in diagrams [2, 3] as we found a decrease in Sum offspring number of males and increases in female rats compared with control group in cases from mating (exposed female x normal male) with the gamma ray at period 7 hours /day for 55 days for doses 0.06,0.1 and 0.4 m Gy/h and this agree with [43-44] also identical with [37-39] whom were used the same parameters as rats or mice as well as the same range of radiation dose rate but they were happened on different objects like hematological and sperm . On the other hand also another study agrees on the male chickens with the same dose rate in m Gy/h.

From Figure 4, we can see a decrease in sex ratio of rats' male which were exposed to gamma ray radiation but in figure (5), we can see an increase in sex ratio of

female rats which were exposed to gamma ray radiation for the copulation (exposed female x normal male) with period 7 hours daily for 55 days of the doses at 0.06,0.1 and 0.4 m Gy/h and that agree with [43].

The reasons which led to changes in sex ratio of male and female rats which were exposed to gamma ray radiation at period 7 hours daily for 55 days of doses at 0.06,0.1 and 0.4 m Gy/h return to analysis or denaturation of ribose nucleic acid DNA because as the electromagnetic waves effect is considered as an ionizing radiation with the ability of penetration t as short waves, therefore cells were effected by thermal way where the exposure to these radiation lead to increase temperature of that part which was exposed to radiation and lead to change in function and structure of the cells That depends on the exposure intensity and value of the radiation energy [45]. Also selecting irradiation period of 55 days with a weak dose rate in mili Gray return to the same dose rate and exposure time were taken in many studies in the similar to this object [37-40], rather than, these parameters close to the dose rate of annual back ground as well as the dose rate near the stores of radioactive materials

The radiations impact by direct method when the particle lose energy inside material and take place energy deposition leading to another charger particles and then send the energy deposition from charger particles to the cell (Latin American Experts Committee on High Frequency Electromagnetic Fields and Human Health, 2010) [46] and this affects the process of mitosis and process of sperm formation specially (x-chromosome) which is a change of female sex without impact on (y- chromosome).Then resulted decrease in activity of sperms brings (y- chromosome) effected in the end on copulation of irradiated rats to causing important changes in sex ratio of female and male rats.

The tester one achieves a series of interactions and chemical changes which cause to increase multiplier of genetic information which is stored in DNA [47]. The multiplier process can lead to produce many series of ribosome nucleic acid (rRNA) which represent an original part to build the protein and many poly messenger ribose nucleic acid (mRNA) which has a function to limit the amino acid series that are completed during response of endrogene much of DNA which becomes inter achieve cell division during the end phase of mitosis [48] which appear the sex ratio% of male and female rats.

Conclusion

The results showed a change in sex ratio of male and female rats by using weak gamma ray in m Gy/h as electromagnetic radiation EMR have harmful effects on some physiological parameters of rats and this knowledge agree with the radio sensitivity of the organs of animals, old, sex and test design. This paper also showed significant change in the ratio, % of the offspring, female exposed to the weak gamma ray more than that of the ratio% of offspring male rats compared with control. This study is an important application that can be achieved on its physiological properties, given that rats are among the mammals and all that happens to them can be applied effectively to people, as well as the possibility of benefiting from that this result may affect somehow on economic animals such as cows, sheep and goats, for example. You receive a radiation dose rate close to this study. According to her results, necessary measures must be taken to prevent her from receiving such doses.

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