

Transgenerational Effects in Mice Exposed to Continuous Low-Dose-Rate Gamma-Rays – Pathological Study –

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Abstract

To study the effects of continuous low-dose-rate gamma-ray irradiation on the progeny of mice, males (sires) were irradiated for 400 days with ^{137}Cs gamma-rays at low-dose-rates of 20 mGy/22 h/day, 1 mGy/22 h/day, and 0.05 mGy/22 h/day with accumulated doses equivalent to 8000 mGy, 400 mGy, and 20 mGy, respectively. Immediately after completion of irradiation, the male mice were bred with non-irradiated females to produce F₁ mice. Randomly selected F₁ males and females were bred to produce F₂ mice. All mice, except the dams of F₁ mice, were subjected to pathological examination upon natural death. Lifespan, cancer incidence and number of offspring were used as parameters to evaluate the biological effects of low-dose-rate irradiation. There were no significant differences in the pregnancy rate and weaning rate in the parent generation. There were, however, significant decreases in the mean litter size ($P=0.029$), as well as the mean number of weaned pups ($P=0.023$) per female bred to males exposed to 20 mGy/22 h/day compared to the non-irradiated controls. Partial results show that significant decreases in the lifespan of male parent mice (F₀, $P=0.007$) exposed to 20 mGy/22 h/day and their male progenies (F₁, $P=0.032$) were observed (Table 1). No significant differences were found in the cause of death and cancer incidence in F₁ and F₂ progeny mice.

Table 1 Mean life spans (Batches 1-4)

Parent male mice (F ₀)	n	Mean (days)	SE	P (Wilcoxon test)
Non-irradiated	100	862.1	19.0	
0.05 mGy/22h/day	100	834.2	21.0	0.321
1 mGy/22h/day	100	860.1	18.9	0.820
20 mGy/22h/day	100	799.3	18.4	0.007
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F ₁ Male mice	n	Mean (days)	SE	P (Wilcoxon test)
Non-irradiated	132	895.0	18.6	
0.05 mGy/22h/day	129	882.6	19.1	0.649
1 mGy/22h/day	152	859.2	18.0	0.170
20 mGy/22h/day	120	835.6	20.2	0.032
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F ₁ Female mice	n	Mean (days)	SE	P (Wilcoxon test)
Non-irradiated	135	795.4	15.5	
0.05 mGy/22h/day	128	802.6	13.8	0.740
1 mGy/22h/day	134	811.8	15.4	0.446
20 mGy/22h/day	110	794.2	18.2	0.959
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F ₂ Male mice	n	Mean (days)	SE	P (Wilcoxon test)
Non-irradiated	223	881.8	13.6	
0.05 mGy/22h/day	162	885.3	17.1	0.867
1 mGy/22h/day	252	883.4	12.2	0.931
20 mGy/22h/day	171	863.3	15.4	0.371
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F ₂ Female mice	n	Mean (days)	SE	P (Wilcoxon test)
Non-irradiated	194	814.0	11.6	
0.05 mGy/22h/day	146	787.3	16.3	0.182
1 mGy/22h/day	213	811.1	11.8	0.871
20 mGy/22h/day	147	808.9	17.0	0.798