Effects of Childhood Low Dose-rate Gamma-ray Exposure in B6C3F1 Mice

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Abstract

The purpose of this multi-year study is to investigate the late biological effects of radiation in relation to age at exposure using mice. During the first year (FY 2021), a preliminary study was conducted to determine the optimal study conditions and establish the parameters for analyses.

Specific pathogen-free (SPF) B6C3F1 mice were irradiated with gamma-rays at two low dose-rates (LDRs; 20 and 100 mGy/day) and one high dose-rate (HDR; 700 mGy/min) from 0 to 8 weeks of age, to total accumulated doses of 1120, 5600 and 1120 mGy, respectively. Body weights were measured periodically and health monitoring was performed on all the irradiated mice, alongside age-matched non-irradiated controls. Mice were sacrificed and subjected to pathological examination (gross and microscopic) following standard operating procedures at 8, 10 and 28 weeks of age.

Health monitoring did not reveal any significant change among the non-irradiated and irradiated groups during the entire study period. Body weights (Fig. 1) were significantly lower in mice exposed to 100 mGy/day, from 5-13 and 5-11 weeks of age in males and females, respectively. At 8 and 10 weeks of age (0 and 2 weeks post-irradiation), the testes and ovaries of irradiated mice weighed significantly less than the non-irradiated controls (Fig. 2). Based on organ weights, testes from mice exposed to a LDR of 100 mGy/day appear to have recovered at 28 weeks of age, whereas the ovaries from the irradiated mice did not.

The results of this preliminary study indicate that while there will be no problems in conducting a life span study, the changes in gonadal weight and resulting dysfunction may be a significant factor that can affect the development of neoplastic and non-neoplastic diseases. In addition to life span, investigations into morphological and functional changes will be performed.



Fig.1 Body weights of B6C3F1 mice exposed to gamma-rays at low (LDRs; 20 and 100 mGy/day) and high (HDR; 700 mGy/min,) dose-rates compared to the non-irradiated controls (mean ±95% confidence interval).



Fig.2 Gonad weights of B6C3F1 mice exposed to gamma-rays at low (LDRs; 20 and 100 mGy/day) and high (HDR;
700 mGy/min) dose-rates compared to the non-irradiated controls (mean±95% confidence interval).