

Report, General

Effects of Chronic Exposure to
Low Levels of Alpha-Emitting
Radionuclides on Health and
Reproductive Fitness of
Mammals: Final Report

Research and Development

153-121241-REPT-019

Revision 0

2014 April

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Revision 0

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CW-511300-FM-168 Rev. 1

Ref. Procedure CW-511300-PRO-161

Document No. / Numéro de document:

153	121241	REPT	019
Doc. Collection ID ID de la collection de doc.	SI Répertoire du sujet	Section	Serial No. N° de série

Document Details / Détails sur le document

Title Titre	Total no. of pages Nbre total de pages
Effects of Chronic Exposure to Low Levels of Alpha-Emitting Radionuclides on Health and Reproductive Fitness of Mammals: Final Report	88

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Revision History / Liste de révisions

Revision / Révision		Details of Rev. / Détails de la rév.	Prepared by Rédigé par	Reviewed by Examiné par	Approved by Approuvé par
No./N°	Date (yyyy/mm/dd)				
D1	2014/03/19	Issued for “Review and Comment”.	S. Walsh M. Stuart A. Festarini M. Bugden S. Kramer-Tremblay	N. Priest	M. O’Kane
0	2014/04/14	Issued as “Approved for Use”.	S. Walsh M. Stuart A. Festarini M. Bugden S. Kramer-Tremblay Acknowledgements: M. Satkunam B. Su H. Peery C. Mothersill Y. Devantier H. Wyatt	N. Priest	M. O’Kane

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1. INTRODUCTION

Atomic Energy of Canada Limited (AECL) and McMaster University formed a partnership to provide data to the Canadian Nuclear Safety Commission (CNSC) on the multigenerational effects of chronic exposure to low levels of alpha-emitting radionuclides on health and reproductive fitness of mammals. This laboratory study will contribute to improve characterization of the resultant ecological risks of the release of alpha-emitting radionuclides and will inform current policies that are relevant to uranium mining and milling in Canada.

The long term (including multigenerational) effects of chronic internal exposure to low-dose alpha emitting radionuclides were studied using target concentrations of 0.01, 0.1, 1.0 and 10.0 Bq/L of Ra-226 in drinking water. The overall objective of these experiments was to verify if such levels have the potential to cause health and/or reproductive effects when organisms are exposed for multiple generations.

The effects of chronic internal exposure to Ra-226 were continuously monitored in the Biological Research Facility (BRF) at AECL. The reproductive fitness data of the first, second and third generations were previously reported to the CNSC in AECL reports 153-121241-REPT-013 (issued in June 2013), 153-121241-REPT-015 (issued in November 2013) and 153-121241-REPT-016 (issued in December 2013).

The weight (including organ weight) data collected from the extra mice at 6 weeks of age in the second, third and fourth generations was reported to the CNSC in AECL reports 153-121241-014 issued in October 2013, 153-121241-017 issued in January 2014 and 153-121241-018 issued in March 2014, respectively.

1.1 Objective

The overall objective was to evaluate whether long term (including multigenerational) exposure to 0.01, 0.1, 1.0 and 10.0 Bq/L of Ra-226 in drinking water could affect biota's health and reproduction. The focus was placed on health and reproductive endpoints. The study is expected to contribute to a better understanding of the effect of alpha radiation at low levels of exposure.

1.2 Selection of the Mouse

The deer mouse (*Peromyscus maniculatus*) was originally chosen as a representative sentinel species because it is a common mammalian species and it is present in the Ra-226 contaminated areas of northern Saskatchewan. However, health profiling of the animals indicated that the stock from the University of California was contaminated with *Helicobacter* as well as other pathogens and parasites. Due to AECL's BRF's Specific-Pathogen-Free (SPF) status, these mice could not be accepted in the research facility. Re-derivation was attempted at Charles River Laboratories but was not a success in a time frame compatible with the proposal's schedule.

As a result, a standard laboratory mouse (CBA/CaJ) from Jackson Laboratories was chosen. The CBA/CaJ strain (Figure 1) is known for its good reproductive record and also known by the staff and administrators of the BRF at AECL.



Figure 1: CBA/CaJ mouse

1.3 Experimental Outline

The experimental design that was followed consisted of a control group and four treatment groups each containing 40 mice (20 males and 20 females) that were exposed to low dose alpha radiation from Ra-226 (see Appendix A). Through the consumption of drinking water containing Ra-226, the four treatment groups were exposed to the following target levels respectively: 0.01, 0.1, 1.0 or 10.0 Bq/L. The drinking water was available on demand. The four levels were chosen because of their environmental relevance and to match the levels employed by the complementary laboratory experiments with fish conducted at McMaster University. As only 40 individuals (20 males and 20 females) per control and treatment group were kept until the fourth generation was obtained, extra individuals above the 800 animals participating in the study were euthanized and used for dosimetric and molecular/cellular endpoint testing at AECL, McMaster University, Laval University or collaborating institutions.

Breeding was done using a random mating system. The mating process involved sexually mature mice (one male and one female) between 8 and 10 weeks of age. The age of breeding was chosen to reflect the young age of reproduction expected in the wild but also to ensure sexual maturity such that variability was reduced.

Each mating was assigned with an individual identification. Following the convention of general rodent colony studies, when a new litter was born, the date and number born were recorded. The weaned young were removed from the mating cages at 4 weeks of age and placed in stock cages separated by gender. Growth, behaviour, breeding success, number of pups per litter, water consumption and general health (including the development of neoplasms) were monitored and recorded. Such information was reported to the CNSC in the above reports. Take note that AECL report 153-121241-REPT-017 stated that the first exposure of Ra-226 took place on April 12th. This was not the actual start date. The date of the start of the Ra-226 exposure was April 24th as displayed in Table 1. AECL report 153-121241-REPT-017 also stated that the biological marker data were collected on July 15th, 2013 while the tissue weights were in fact collected on this date. The biological marker data were collected between July 8th and 11th as presented in Table 1.

**Table 1:
Timeline of the study**

Date(s)	Step	Comments	Ra-226 exposure
2013 April 8	Received Gen 1 mice	Mice were 4-6 weeks of age	No
2013 April 24	Gen 1 first exposure to Ra-226	Mice were 7-8 weeks of age	Yes
2013 May 6	Breeding Gen 1	Mice were 8-10 weeks of age	Yes
2013 May 29	Average date of birth Gen 2		Yes
2013 June 26	Weaned Gen 2	Mice were 4 weeks of age	Yes
2013 July 8-11	Extra Gen 2 mice euthanized, biological marker data were collected	Mice were 6 weeks of age	Yes
2013 July 15	Extra Gen 2 mice euthanized, tissue weights were collected	Mice were 7 weeks of age	Yes
2013 July 22	Breeding Gen 2	Mice were 8 weeks of age	Yes
2013 August 14	Average date of birth Gen 3		Yes
2013 August 20-26	Daily water consumption monitored for Gen 2 males	Mice were 12 weeks of age	Yes
2013 August 28-September 11	Daily water consumption monitored for Gen 1 males	Mice were 23 weeks of age	Yes
2013 September 6-20	Daily water consumption monitored for Gen 1 females	Mice were 27 weeks of age	Yes
2013 September 11	Weaned Gen 3	Mice were 4 weeks of age	Yes
2013 September 16-19	Extra Gen 3 mice euthanized, biological marker data were collected	Mice were 5 weeks of age	Yes
2013 September 23-26	Extra Gen 3 mice euthanized, tissue weights were collected	Mice were 6 weeks of age	Yes
2013 September 26-October 3	Daily water consumption monitored for Gen 2 females	Mice were 17 weeks of age	Yes
2013 October 8	Breeding Gen 3	Mice were 8 weeks of age	Yes
2013 October 31	Average date of birth Gen 4		Yes
2013 October 29-November 12	Daily water consumption monitored for Gen 3 males	Mice were 12 weeks of age	Yes
2013 November 11-14	Experimental Gen 1 mice euthanized	Mice were 35-37 weeks of age	Yes

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Date(s)	Step	Comments	Ra-226 exposure
2013 November 18-21	Experimental Gen 2 mice euthanized	Mice were 25 weeks of age	Yes
2013 November 25	Weaned Gen 4	Mice were 4 weeks of age	Yes
2013 November 25-28	Experimental Gen 3 mice euthanized	Mice were 15 weeks of age	Yes
2013 December 9-12	Gen 4 mice euthanized , biological marker data were collected	Mice were 6 weeks of age	Yes
2013 December 16-19	Extra Gen 4 mice euthanized, tissue weights were collected	Mice were 6-7 weeks of age	Yes
2013 December 5-16	Daily water consumption monitored for Gen 3 females	Mice were 17 weeks of age	Yes
2013 December 16-19	All remaining mice euthanized	Gen 4 mice-7 weeks of age Gen 3 mice-18 weeks of age Gen 2 mice-29 weeks of age Gen 1 mice-40 weeks of age	Yes

2. WATER (RADIUM-226)

2.1 Expected and measured Ra-226 levels in drinking water

Table 2 provides an overview of the target and actual Ra-226 levels in the water consumed by the control and treatment mice at different time periods. The levels reported in AECL report 153-121241-REPT-015 were found to be erroneous as a calculation error was noted. The corrected values are given in this report.

**Table 2:
Ra-226 measured in water**

Date	Ra-226 measured in water (Bq/L)	
	Expected	Measured
2013 April 24 (first stock solution)	10.0	8.16 ± 0.31
	1.0	0.70 ± 0.01
	0.1	0.0785 ± 0.0139
	0.01	0.0205 ± 0.0154
	Control	0.0025 ± 0.0025
2013 May 09 (check point)	10.0	6.33 ± 0.27
	1.0	N/A
	0.1	0.0759 ± 0.014
	0.01	0.0084 ± 0.0009
	Control	0.0016 ± 0.0004
2013 October 29 (second stock solution)	10.0	8.61 ± 0.33
	1.0	0.86 ± 0.04
	0.1	0.0744 ± 0.0069
	0.01	0.0081 ± 0.0009
	Control	0.0010 ± 0.0002

**For a period of about 4 weeks prior to making the second stock solution, the 10.0 Bq/L drinking water was filtered, sterilized and re-used frequently to minimize waste. This led to a slow decrease in Ra-226 concentration in the water over time. The levels decreased to 4.07 ± 0.20 Bq/L before being re-adjusted. The 10.0 Bq/L levels were re-evaluated on November 15th and were found to be 7.55 ± 0.27 Bq/L.*

2.2 Ra-226 measurements in water samples

2.2.1 Ra-226 measurement of control, 0.01 Bq/L, 0.1 Bq/L and 1.0 Bq/L water samples

Water samples (<10.0 Bq/L) for Ra-226 analysis were collected in 250 mL centrifuge tubes. Approximately 2 disintegrations per minute (dpm) of Th-228 tracer, 0.5 mL of 7% TiOCl_2 (followed by vortexing) and 12 mL of NH_4OH (followed by vortexing) were added to each sample. The pH was measured and the sample was left to stand for 5 minutes. The sample was

then centrifuged at 3500 rpm for 3 minutes, the supernatant was discarded and the pellet was washed twice with 30 mL of ultra pure water (UPW). After a second centrifugation, the rinse water was discarded. The precipitate was dissolved in 1.25 mL of 9 M H₂SO₄ and diluted to 15 mL with UPW. The 15 mL solution was counted on an Octete Plus Alpha Spectroscopy Workstation for 48 hours.

2.2.2 Ra-226 measurement of 10.0 Bq/L and stock solution water samples

Water samples (≥ 10.0 Bq/L) for Ra-226 analysis were collected in 15 mL centrifuge tubes. About 2 dpm of Th-228 tracer, 0.9 mL of 9 M H₂SO₄, 50 μ g of Ba and 5 mL of isopropanol were added to the water sample. The sample was then mixed by shaking the solution and the time was recorded. The sample was left to stand for 30 minutes and then filtered through a membrane apparatus. The membrane was mounted on a stainless steel disk, allowed to dry and counted on an Octete Plus Alpha Spectroscopy Workstation for 48 hours.

3. ESTIMATED WATER CONSUMPTION LEVELS

The average water consumption of male and female mice from the first (23-27 weeks of age), second (12-17 weeks of age) and third (12-17 weeks of age) generations were monitored over a 2 week period by recording the weights of the water bottles before and after giving them to the mice. The consumption data for the first, second and third generations were previously reported in AECL report 153-121241-REPT-017. Water consumption levels were not monitored for the fourth generation due to the timeframe of the study. For this reason, the values obtained for the older generations were extended to the fourth generation. The overall average daily water consumption for males and females was obtained by calculating the average of water consumption rates measured in the first, second and third generations (Figure 2). For the males, a value of 3.27 ± 0.63 mL/day was obtained and females had an average consumption rate of 2.97 ± 0.62 mL/day. These ranges of daily water consumption levels were used to estimate lifetime water consumption levels (starting at weaning) for the four generations (Table 3).

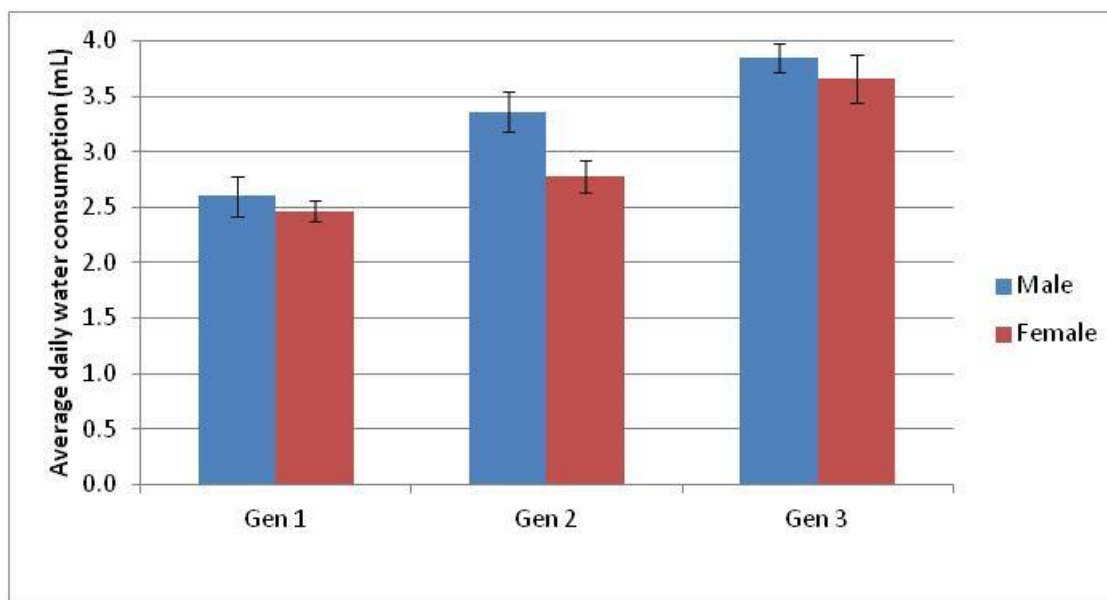


Figure 2: Average daily water consumption levels for males (23 weeks of age) and females (27 weeks of age) in the first generation, males (12 weeks of age) and females (17 weeks of age) in the second generation and males (12 weeks of age) and females (17 weeks of age) in the third generation.

Table 3:
Estimated ranges of potential lifetime water consumption for the first, second, third and fourth generations.

	**Generation 1	Generation 2	Generation 3	Generation 4
Experimental mice estimated lifetime water consumption (mL) (based on average)	<i>35-37 weeks of age</i>	<i>25 weeks of age</i>	<i>15 weeks of age</i>	<i>6 weeks of age</i>
	Males: 499 – 924 (687)	Males: 338 – 588 (481)	Males: 177 – 308 (252)	Males: 32 – 56* (46)
	Females: 521 – 924 (624)	Females: 353 – 588 (436)	Females: 185 – 308 (229)	Females: 34 – 56* (42)
Extra mice estimated lifetime water consumption (mL) (based on average)	<i>38-40 weeks of age</i>	<i>29 weeks of age</i>	<i>18 weeks of age</i>	<i>7 weeks of age</i>
	Males: 580 – 1008 (778)	Males: 403 – 700 (572)	Males: 225 – 392 (320)	Males: 48 – 84 (69)
	Females: 605 – 1008 (707)	Females: 420 – 700 (520)	Females: 235 – 392 (291)	Females: 50 – 84 (62)

Note: The average daily water consumption for males was 3.27 ± 0.63 mL and for females was 2.97 ± 0.62 mL.

**Same applies for extra Generation 2 mice euthanized at 6 weeks of age (July 8-11th) and Generation 3 mice euthanized at 6 weeks of age (September 23-26th).*

***The average age at the start of the exposure was 6 weeks.*

Equation 1

Estimated lifetime water consumption (mL) = (Age at euthanasia – 4 weeks (Gen 2, 3 & 4) or – 6 weeks (Gen 1)) * 7 (days/week)*average daily water consumption (mL/day)

4. HEALTH RELATED DEATHS

During the study there were two unexpected adult female deaths and 11-plus pup fatalities. There were two cases of cannibalism where mothers ate their young. On June 3rd, 4 second generation pups born in the 10.0 Bq/L treatment group were killed by their mothers. Another act of cannibalism was discovered on August 16th; the remains of third generation control pups were found but the number could not be estimated. On August 9th, a second generation pregnant female in the 0.1 Bq/L group was found deceased. Upon dissection, 7 developed pups were located in her uterus. No abnormal findings were observed. Finally, on September 6th, a first generation female in the 0.01 Bq/L treatment group was euthanized due to severe dehydration. Her tail had been trapped between the cover and the cage and she could not access the water and food.

None of these deaths could be attributed to the Ra-226 exposures.

5. GROWTH DATA

Physiological endpoints for the mice in the four generations were continuously monitored during the experiment. The preceding sections provide information on the growth data collected at cage changes and dissection days.

5.1 Weight of the first, second and third generations as a function of time

The growth of the first, second and third generations were monitored over the duration of the study. Figures 3-8 depict the growth patterns of male and female mice in the control and treatment groups over time. Since the fourth generation of mice were euthanized shortly after weaning (6-7 weeks of age), a comparison of growth as a function of time was not completed. No marked difference could be attributed to Ra-226 exposures.

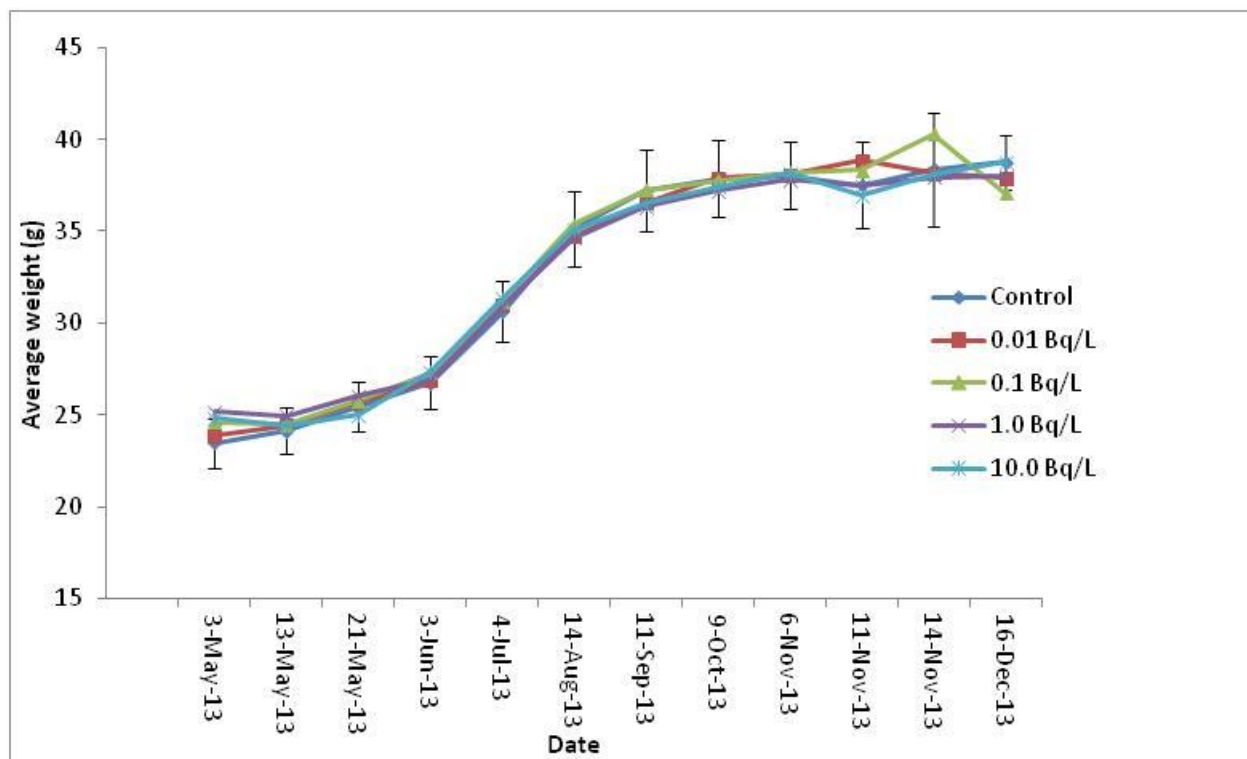


Figure 3: Average weight as a function of time of the first generation of male mice. Error bars of the control group are shown on the graph.

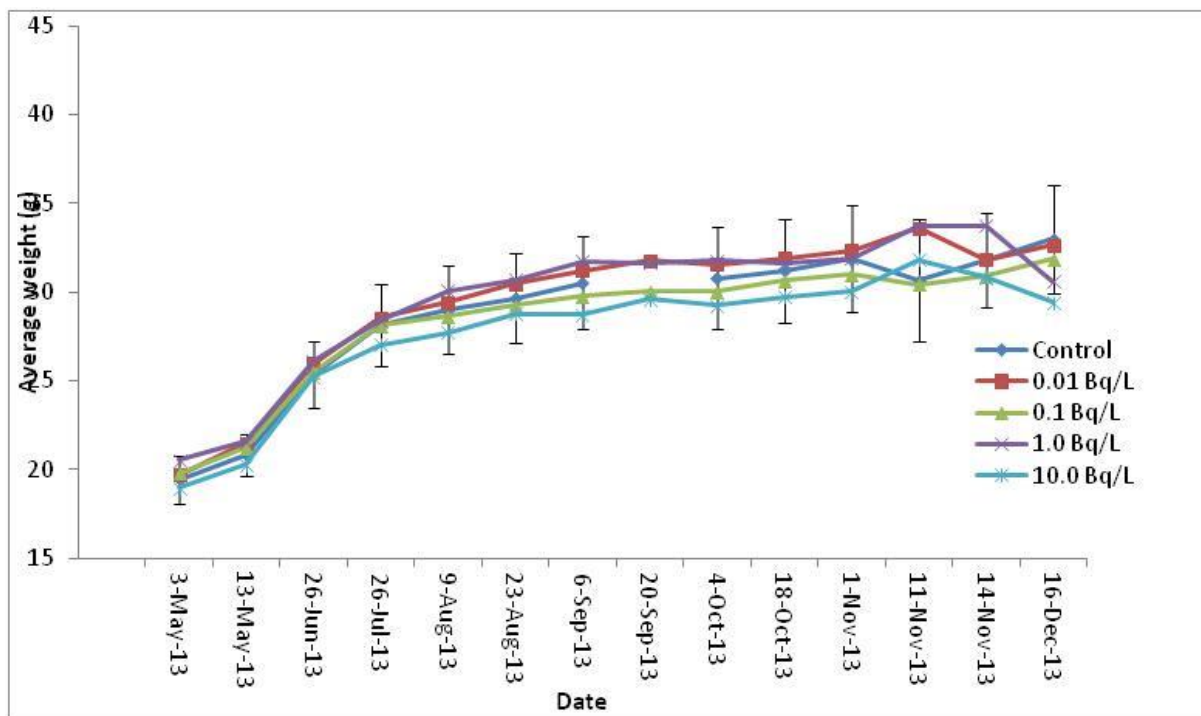


Figure 4: Average weight as a function of time of the first generation of female mice. Error bars of the control group are shown on the graph.

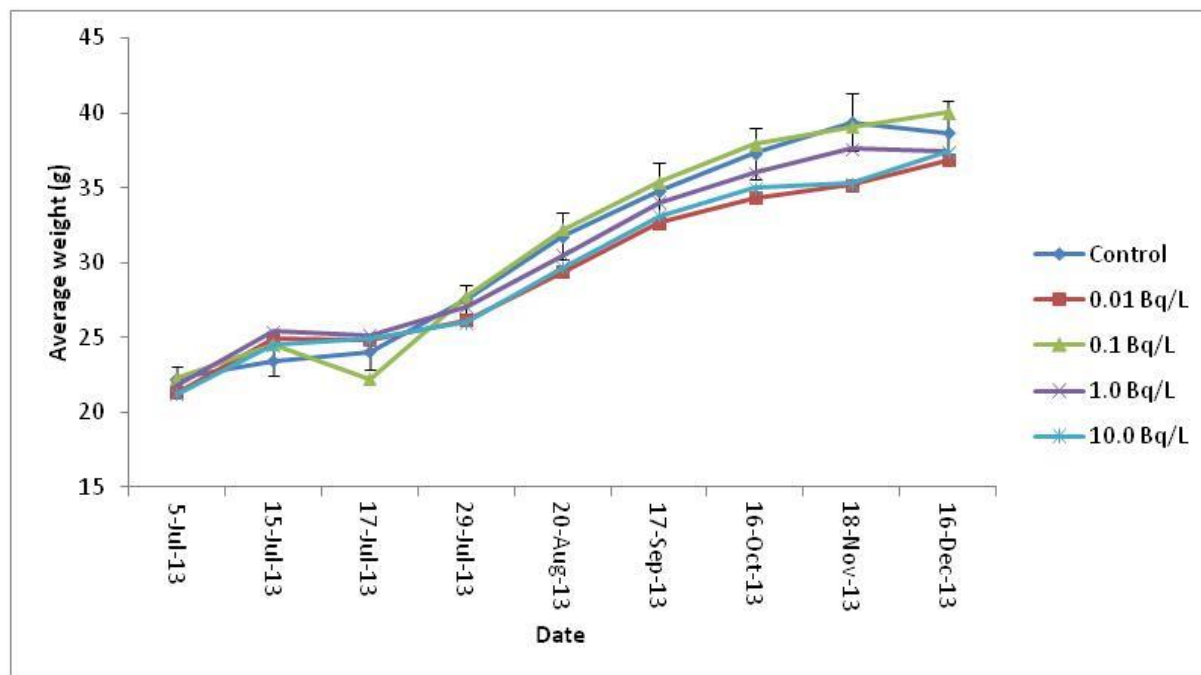


Figure 5: Average weight as a function of time of the second generation of male mice. Error bars of the control group are shown on the graph.

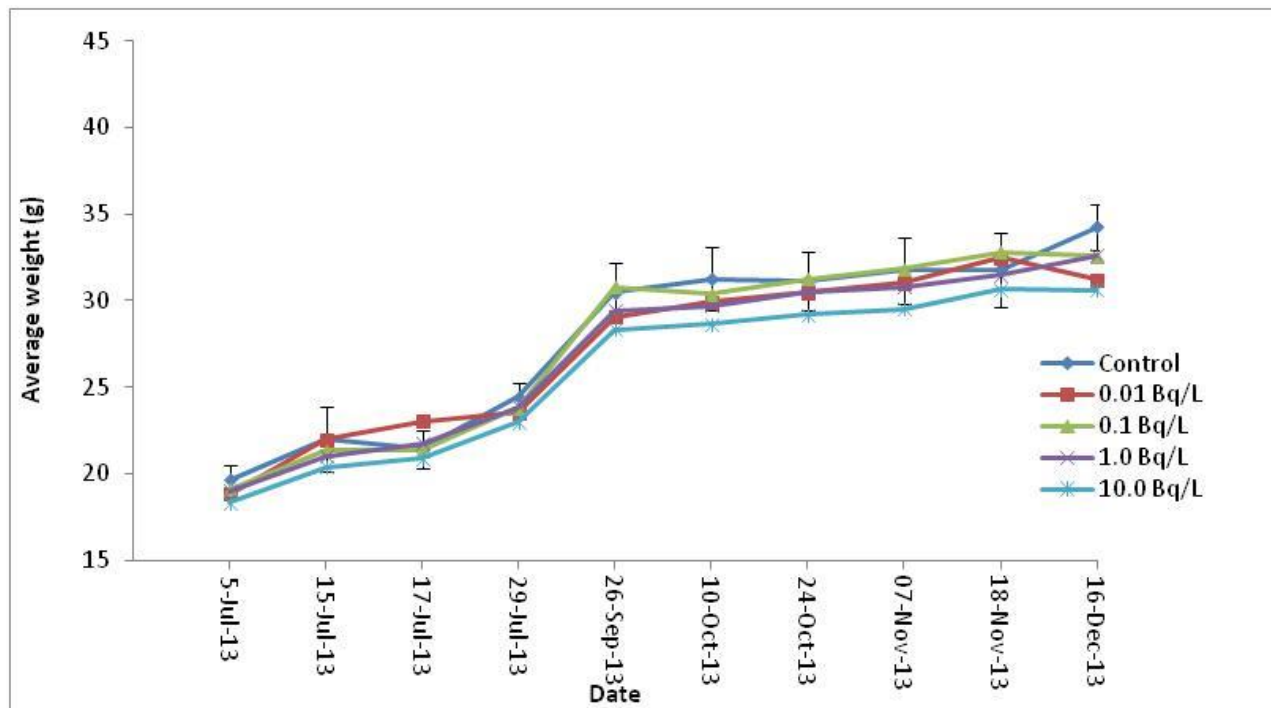


Figure 6: Average weight as a function of time of the second generation of female mice. Error bars of the control group are shown on the graph.

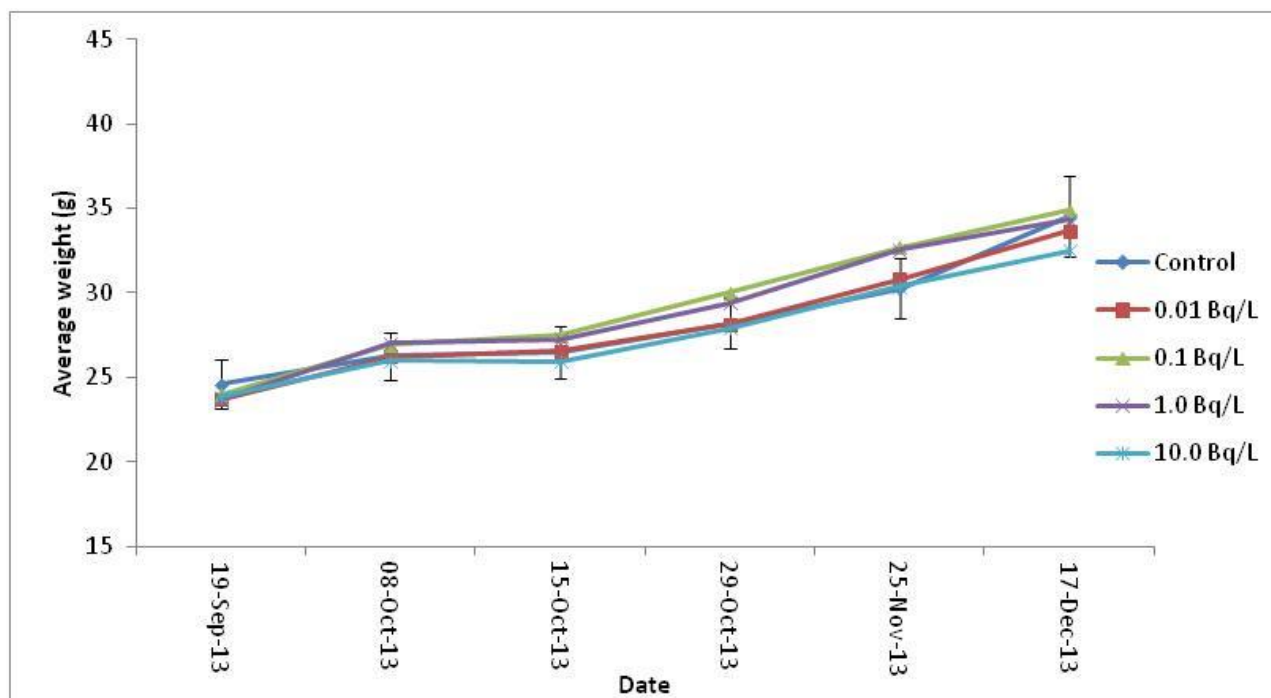


Figure 7: Average weight as a function of time of the third generation of male mice. Error bars of the control group are shown on the graph.

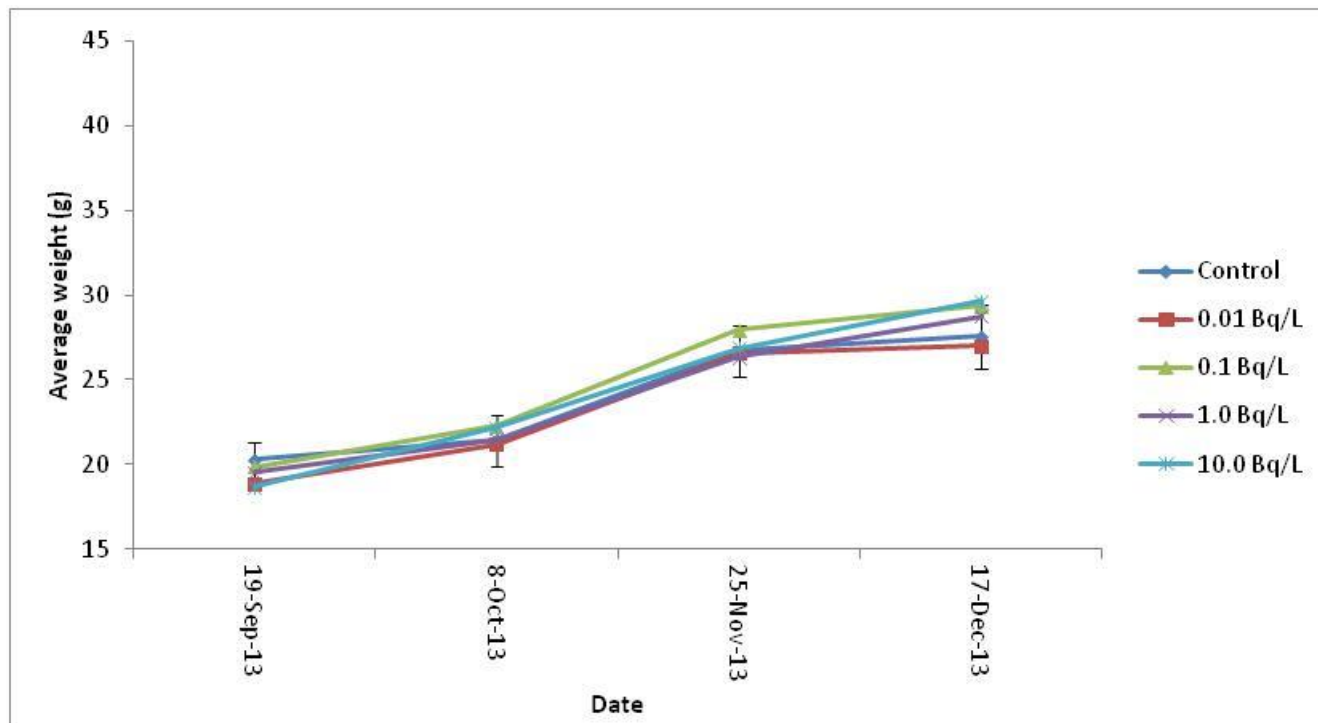


Figure 8: Average weight as a function of time of the third generation of female mice. Error bars of the control group are shown on the graph.

5.2 Comparisons of weight over time between the four generations

Figures 9-18 compare weight over time between the first, second, third and fourth generations for males and females in the control and each of the treatment groups. Refer to Appendix C for the raw data associated with the following graphs. It was observed that in general, the second generation had greater average body weights in the control and all treatment groups over the duration of the study compared to the first and third generations. It was noted that the first generation generally had lower average body weights in all groups while the third generation had average body weights between those recorded for the first and second generations. There are not enough weight data from the fourth generation to compare to the other generations, although the few data obtained seemed to most closely match generation 1 values. Litter sizes (or total number of pups) may explain such differences. This will be discussed in Section 6.

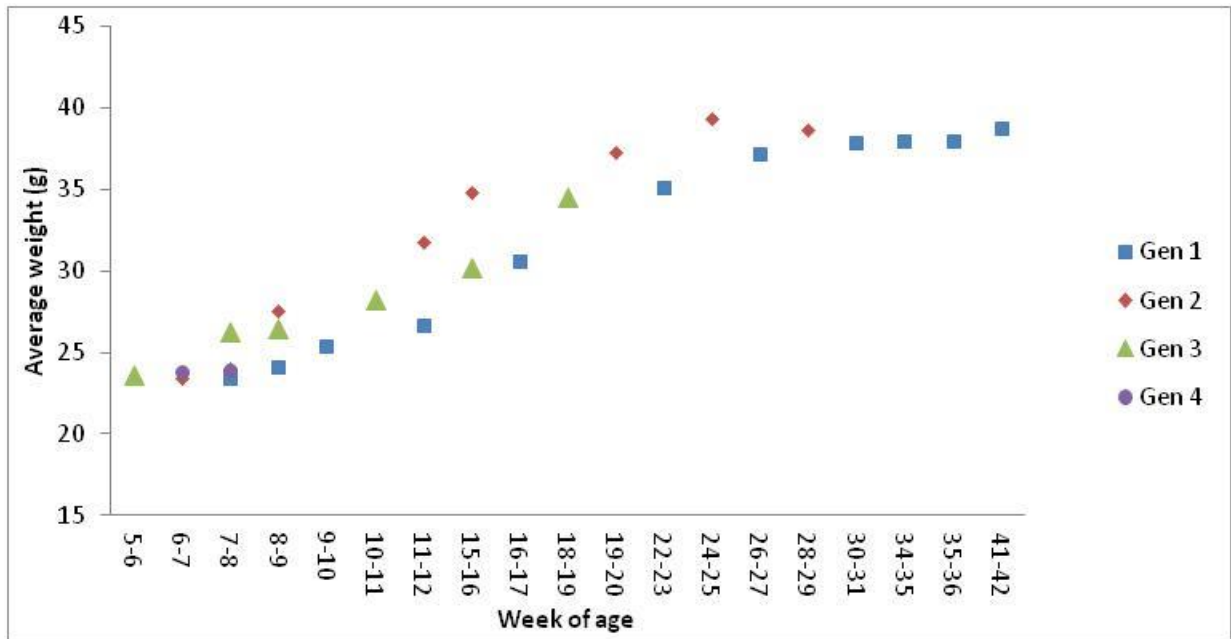


Figure 9: Comparison of weight as a function of time between the first, second, third and fourth generation male mice in the Control group.

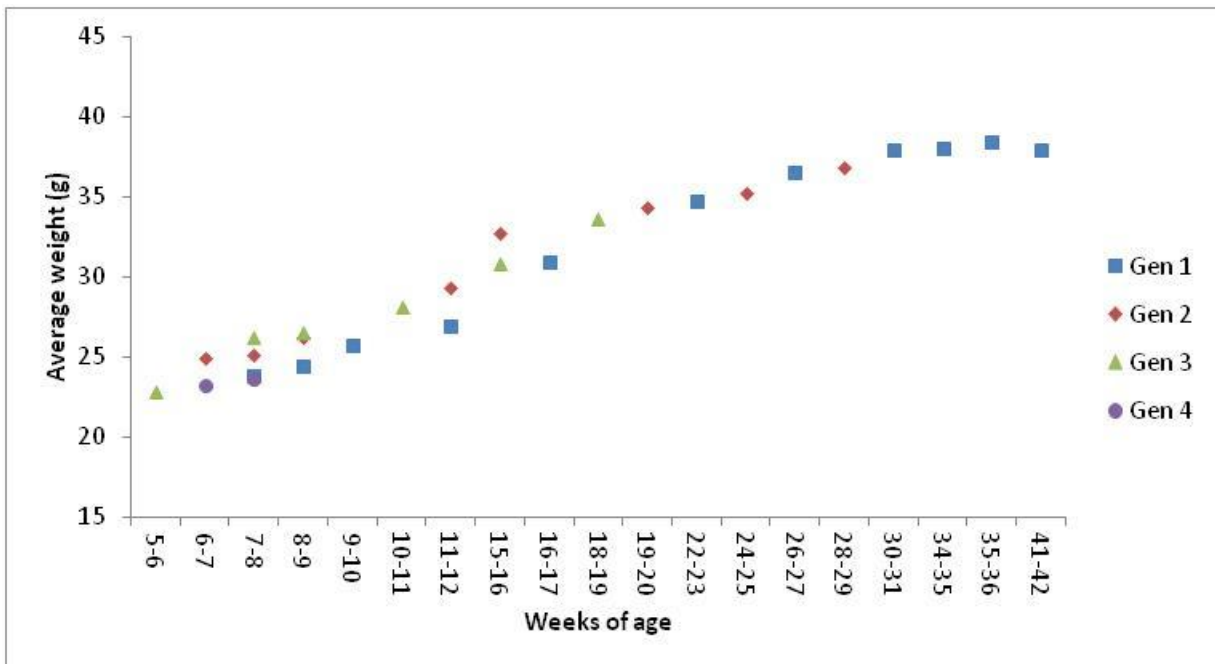


Figure 10: Comparison of weight over time between the first, second, third and fourth generation male mice in the 0.01 Bq/L group.

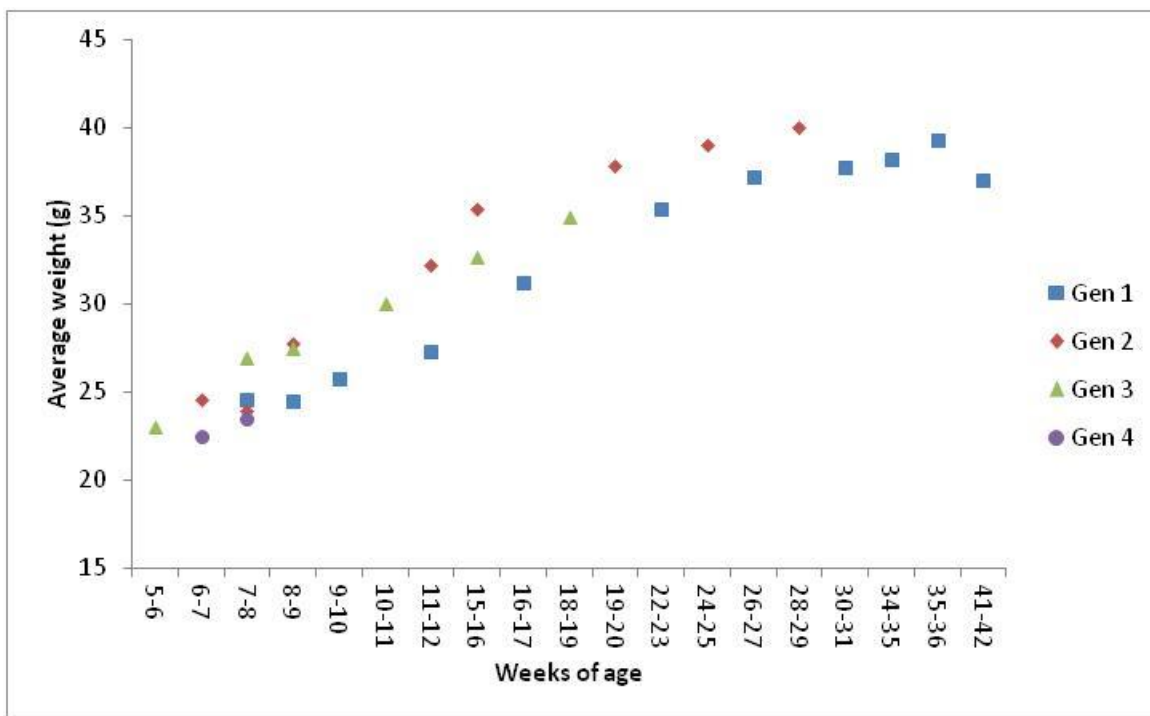


Figure 11: Comparison of weight over time between the first, second, third and fourth generation male mice in the 0.1 Bq/L group.

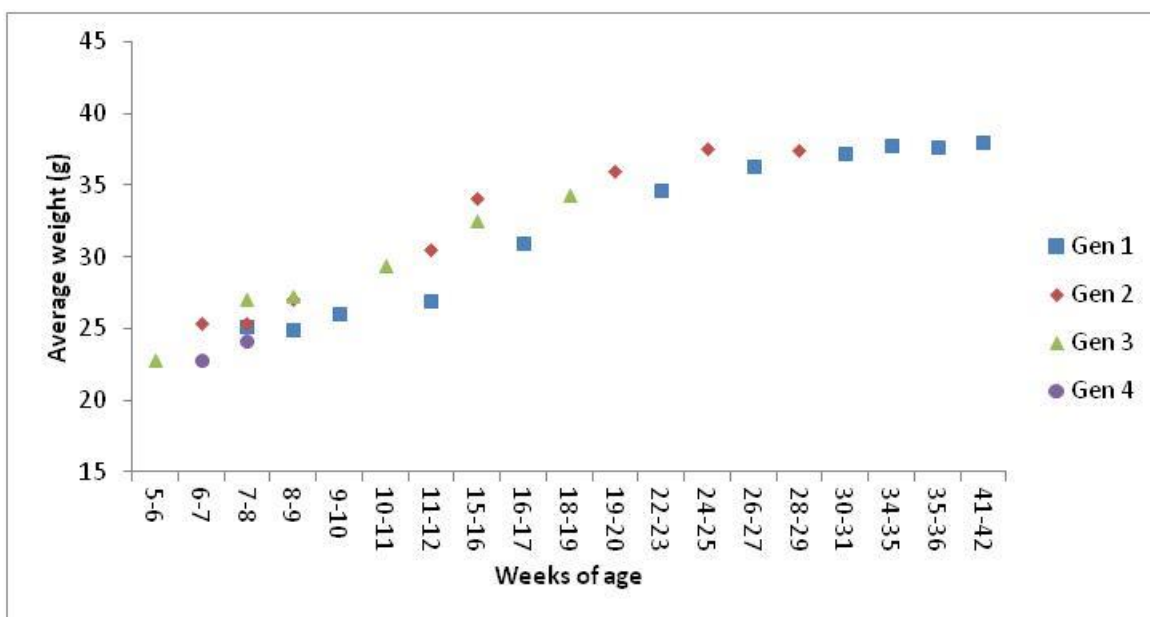


Figure 12: Comparison of weight over time between the first, second, third and fourth generation male mice in the 1.0 Bq/L group.

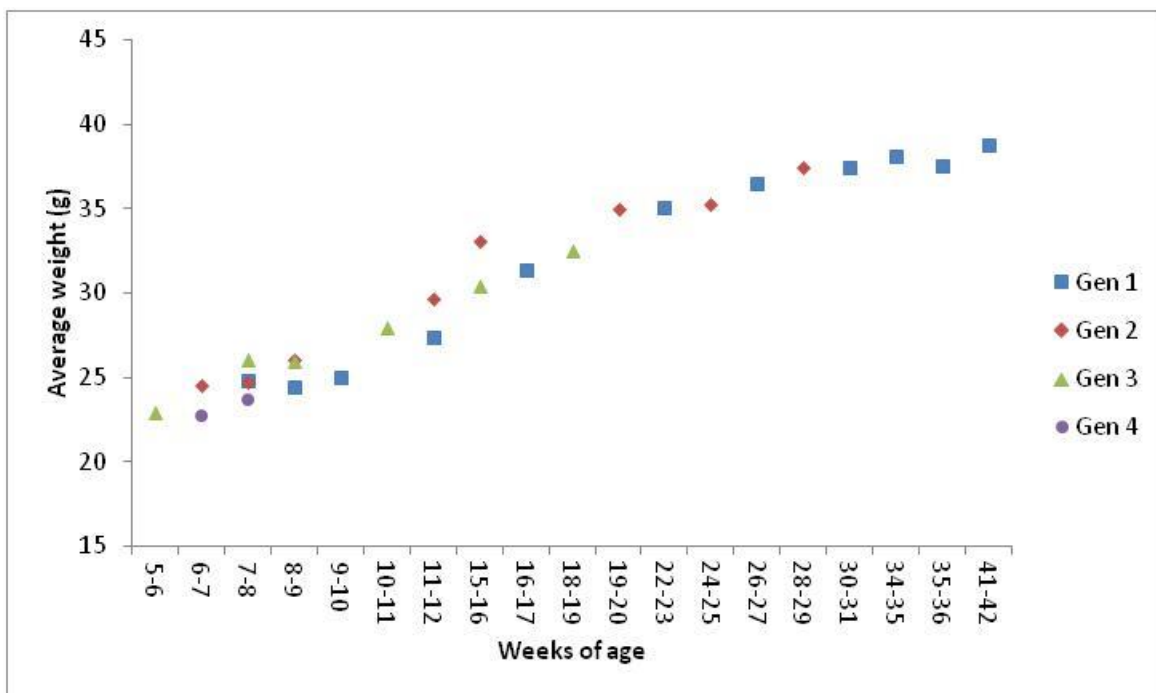


Figure 13: Comparison of weight over time between the first, second, third and fourth generation male mice in the 10.0 Bq/L group.

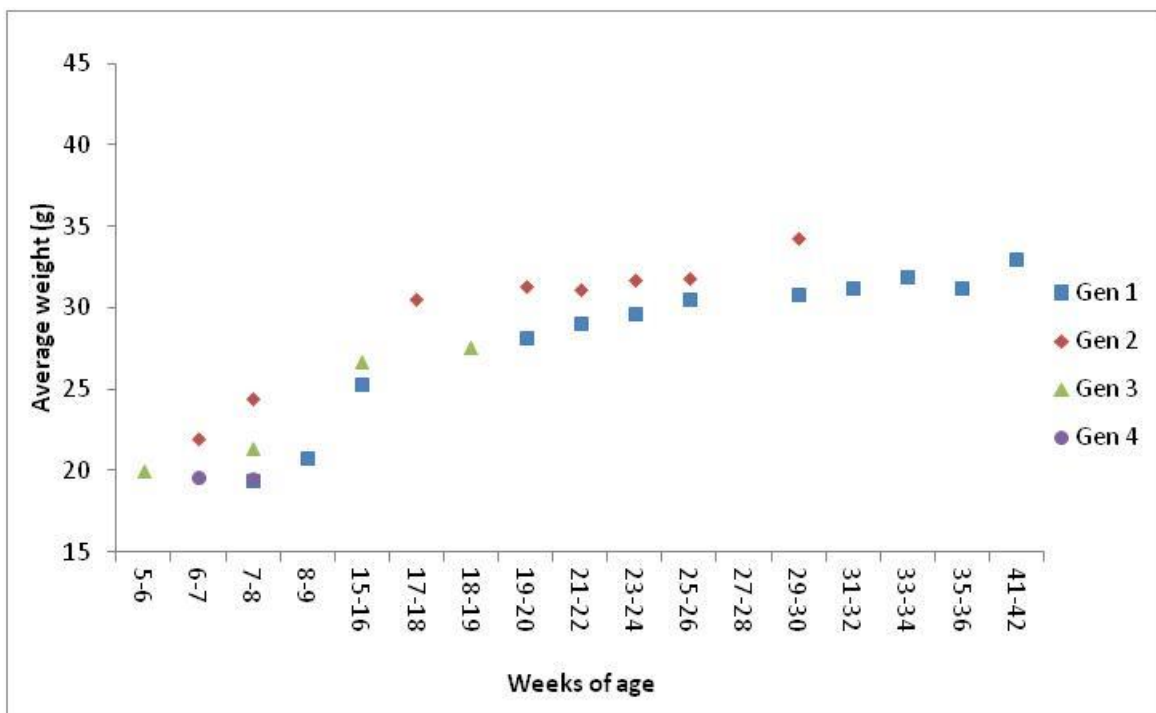


Figure 14: Comparison of weight over time between the first, second, third and fourth generation female mice in the Control group.

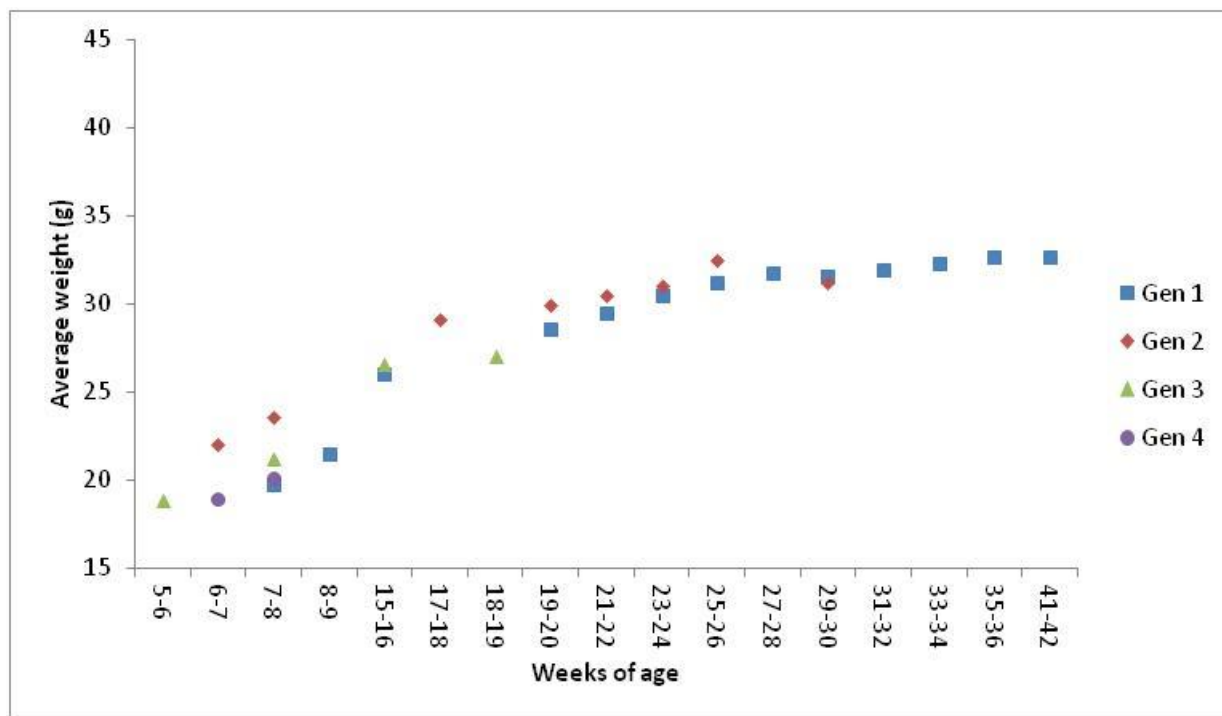


Figure 15: Comparison of weight over time between the first, second, third and fourth generation female mice in the 0.01 Bq/L group.

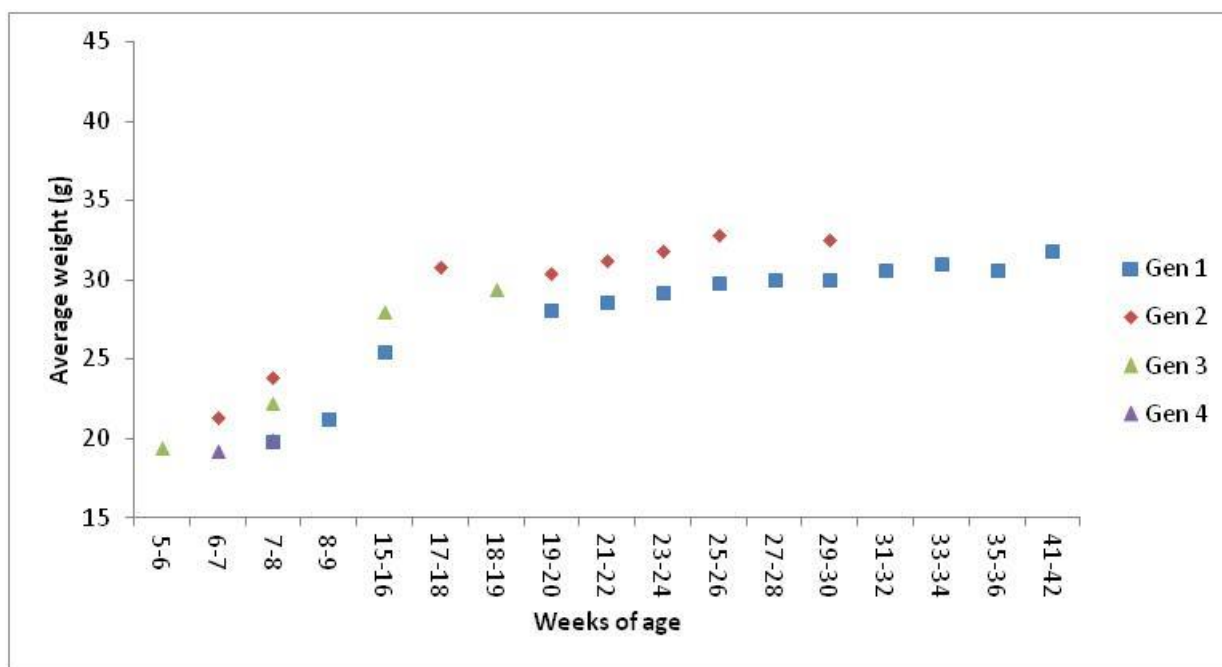


Figure 16: Comparison of weight over time between the first, second, third and fourth generation female mice in the 0.1 Bq/L group.

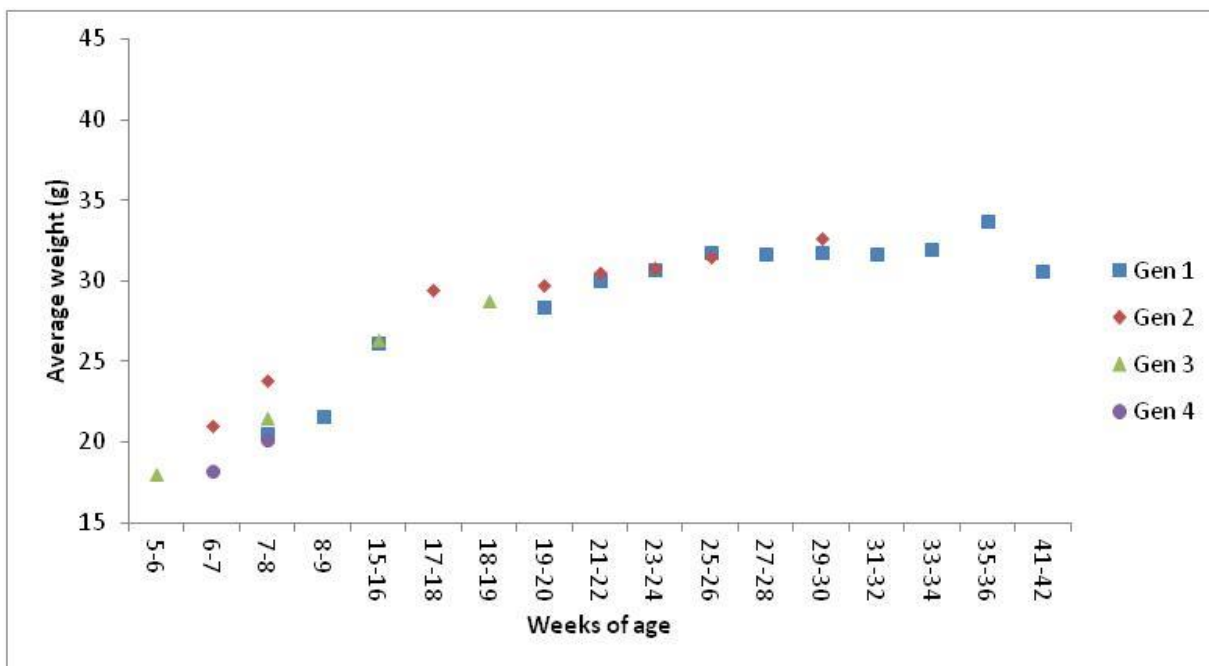


Figure 17: Comparison of weight over time between the first, second, third and fourth generation female mice in the 1.0 Bq/L group.

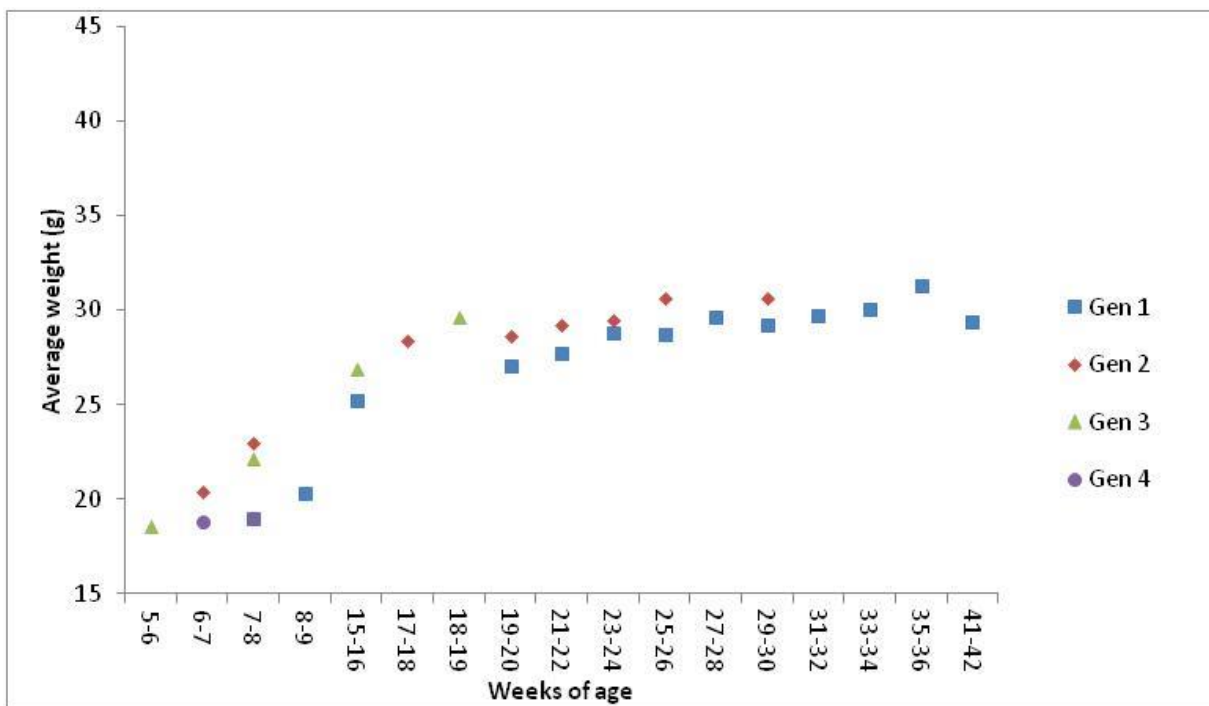


Figure 18: Comparison of weight over time between the first, second, third and fourth generation female mice in the 10.0 Bq/L group.

5.3 Comparison of weight and length data of the extra mice in the second, third and fourth generations collected at 6 weeks of age

As outlined in the experimental design, extra mice not required for the study were euthanized 1-3 weeks following weaning and used for endpoint testing. The body weight and lengths collected from 10 individuals (5 males and 5 females) from each group in the second generation, 28 mice (14 males and 14 females) from each group in the third generation and 10 individuals (5 males and 5 females) from each group in the fourth generation euthanized at 6 weeks of age are compared in Figures 19-24. It is estimated that 6 week old mice would consume between 32.0 – 56.0 mL of water (after weaning) in their lifetime (Section 3). This corresponds to an average of 46.0 mL for males and 42.0 mL for females. Such data is presented in more detail in AECL reports 153-121241-REPT-014, 153-121241-REPT-017 and 153-121241-REPT-018.

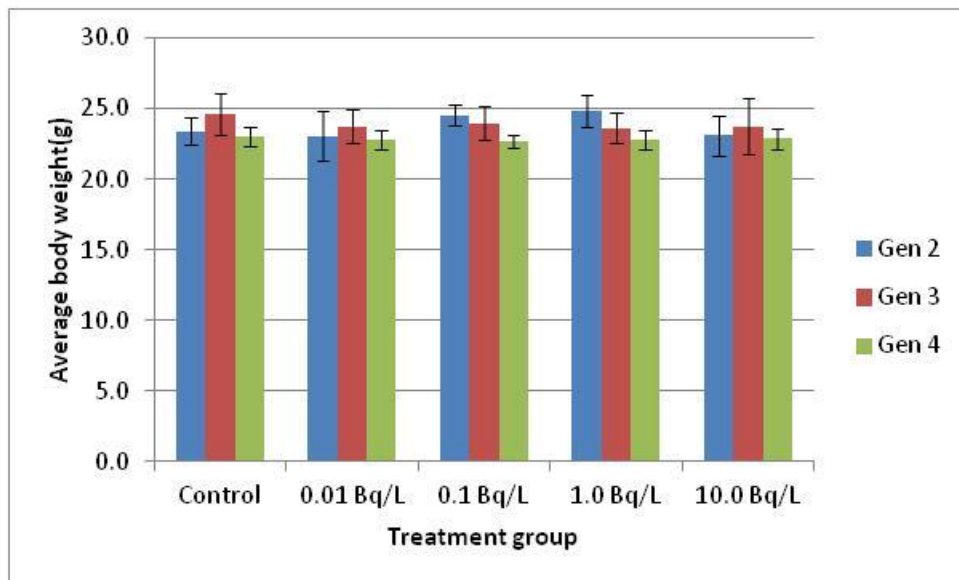


Figure 19: Comparison of average male body weights of the second, third and fourth generations at 6 weeks of age.

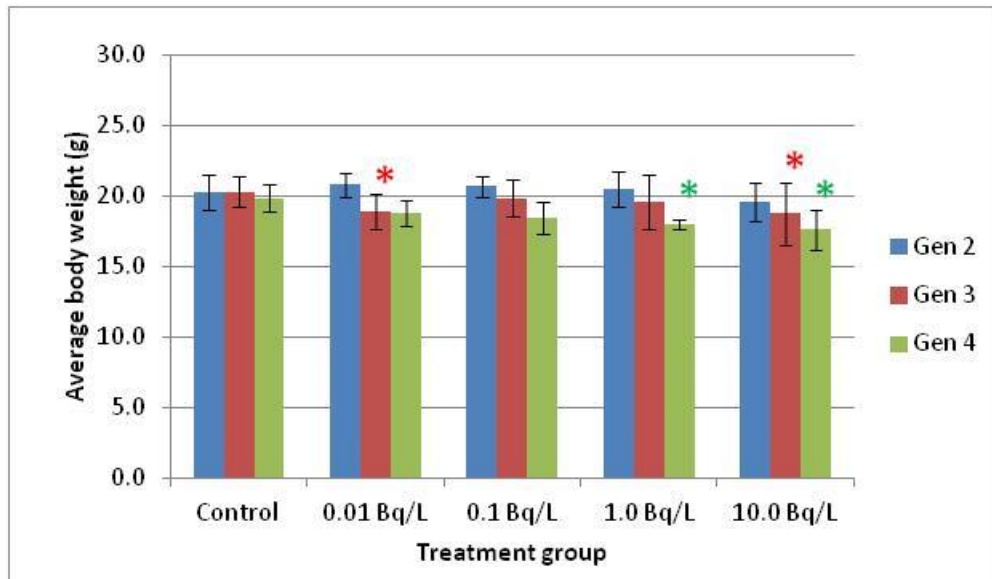


Figure 20: Comparison of average female body weights of the second, third and fourth generations at 6 weeks of age. * Indicates statistical difference from corresponding control.

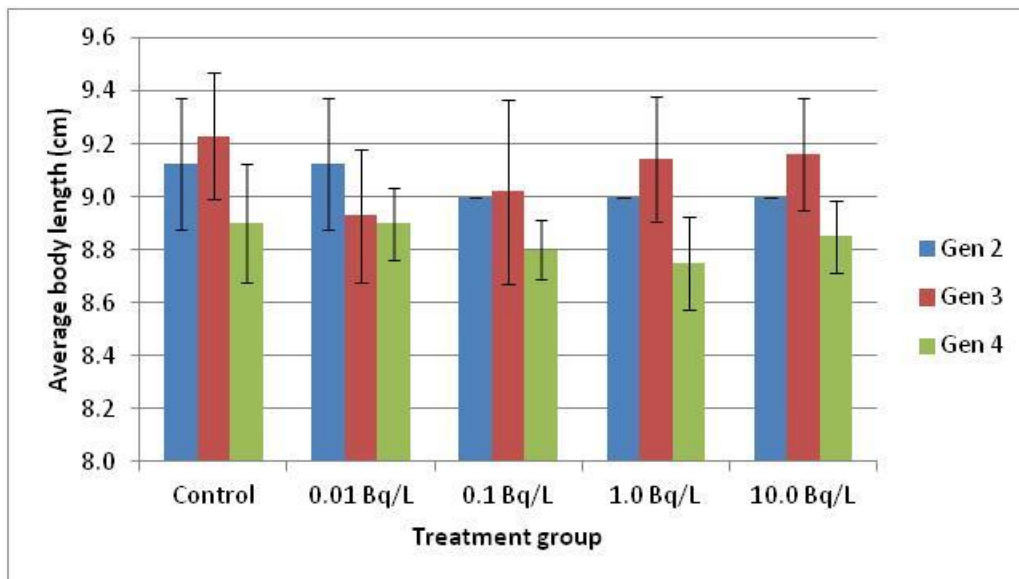


Figure 21: Comparison of average male body lengths of the second, third and fourth generations at 6 weeks of age.

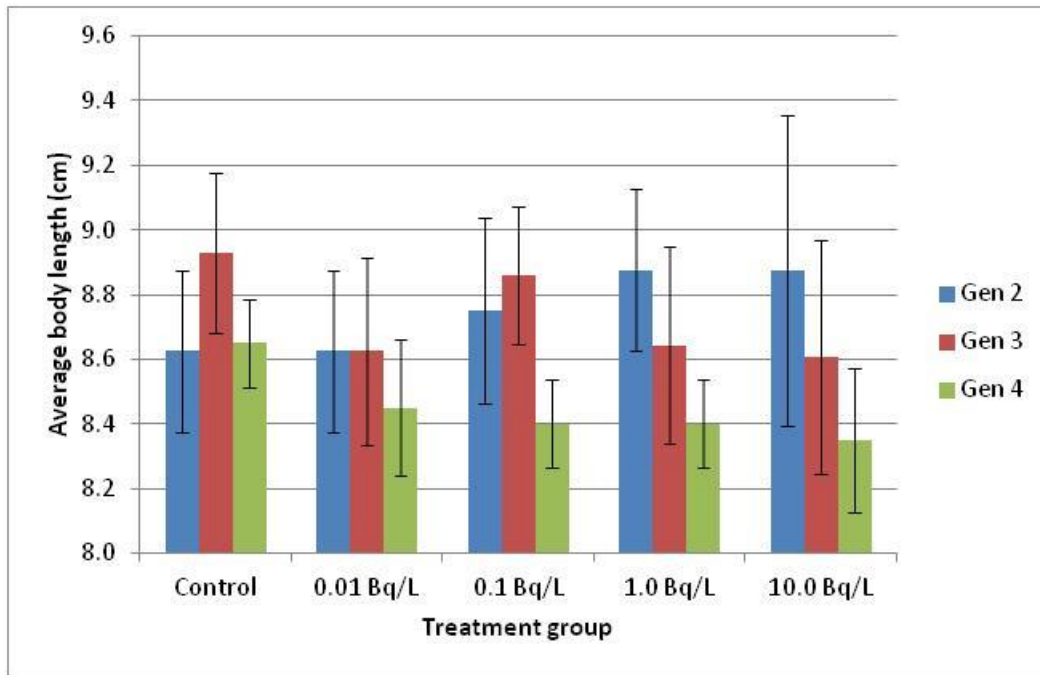


Figure 22: Comparison of average female body lengths of the second, third and fourth generations at 6 weeks of age.

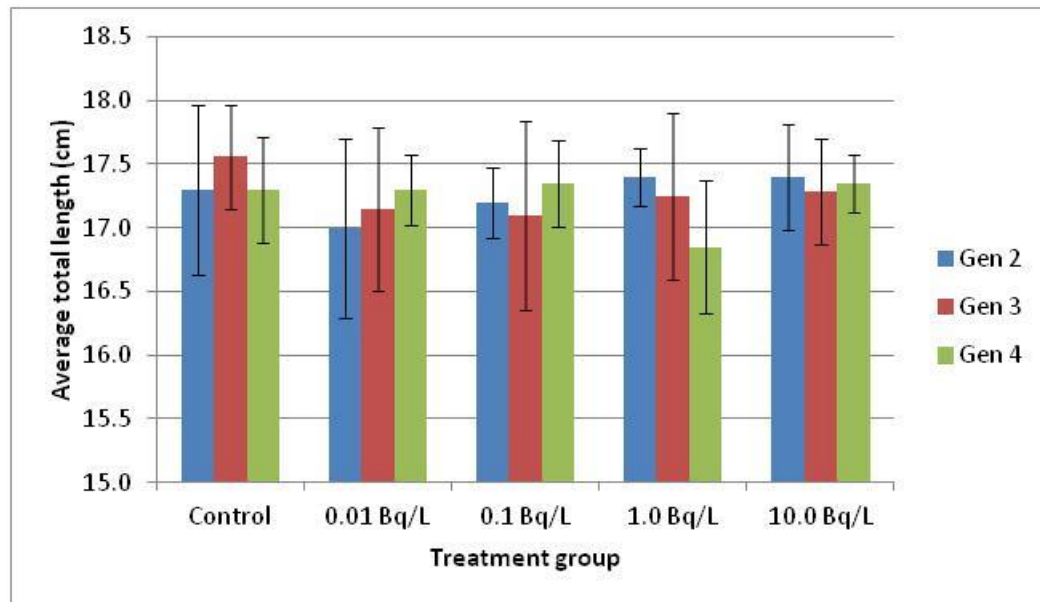


Figure 23: Comparison of average male total lengths of the second, third and fourth generations at 6 weeks of age.

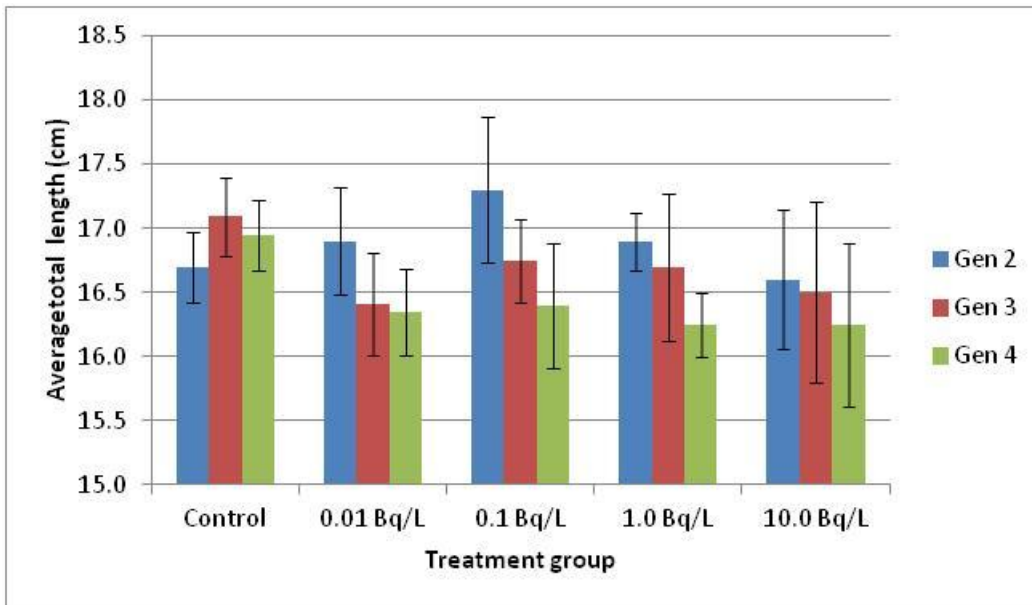


Figure 24: Comparison of average female total lengths of the second, third and fourth generations at 6 weeks of age.

When comparing the average body weights of 6 week old mice for all 3 generations, no differences were consistently observed between generations. It follows that there is no indication of changes due to Ra-226 exposure. No differences between treatment groups and controls were noted for the 3 generations for length measurements.

6. REPRODUCTION DATA

Refer to AECL reports 153-121241-REPT-013 issued in June 2013, 153-121241-REPT-015 (issued in November 2013) and 153-121241-REPT-016 (issued in December 2013) for more information on the reproductive fitness of the first, second and third generations. The sections below provide comparisons of the pregnancy rates and number of offspring produced per pregnancy of the three parent generations. At breeding time, first generation female mice would have consumed approximately 41.6 mL of water while the second and third generation female mice would have consumed about 83.2 mL of water since weaning. First generation male mice, at 8 weeks of age, would have consumed about 45.8 mL of water and the second and third generation male mice would have consumed approximately 91.6 mL of water since weaning.

6.1 Pregnancy rates of first, second and third generations

Figure 25 provides a comparison of pregnancy rates between the 3 parent generations. Figure 26 compares body weight of females at 8 weeks of age (at breeding time) with pregnancy rate.

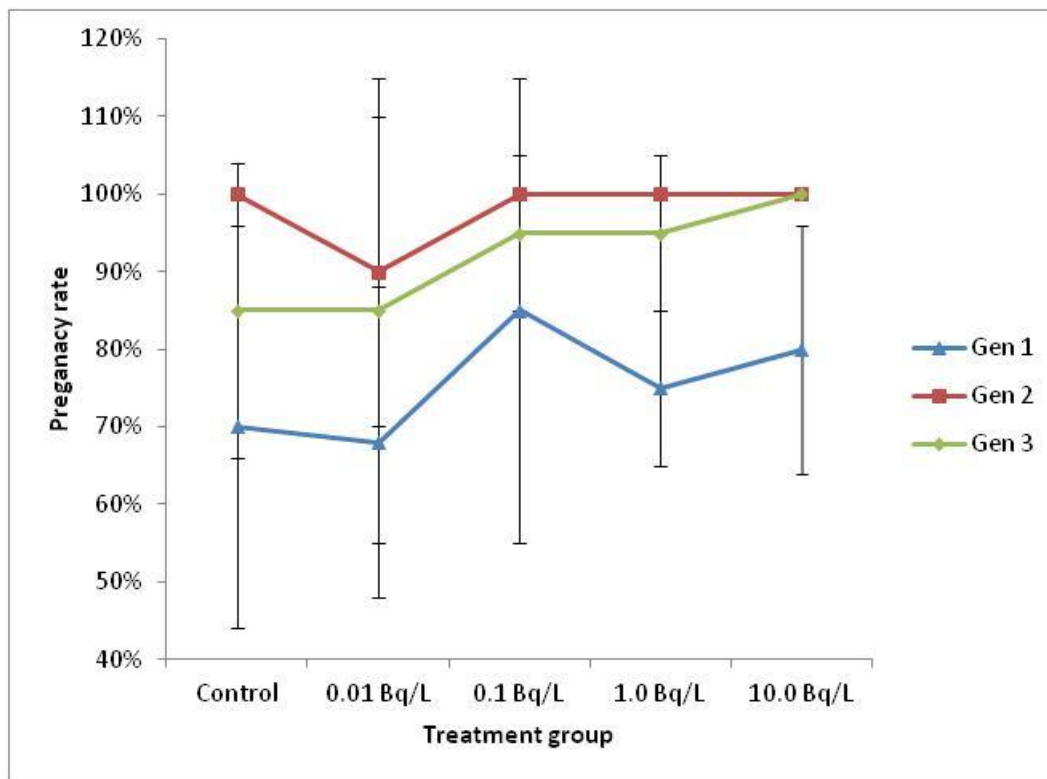


Figure 25: Comparison of pregnancy rates among females in the first, second and third generations.

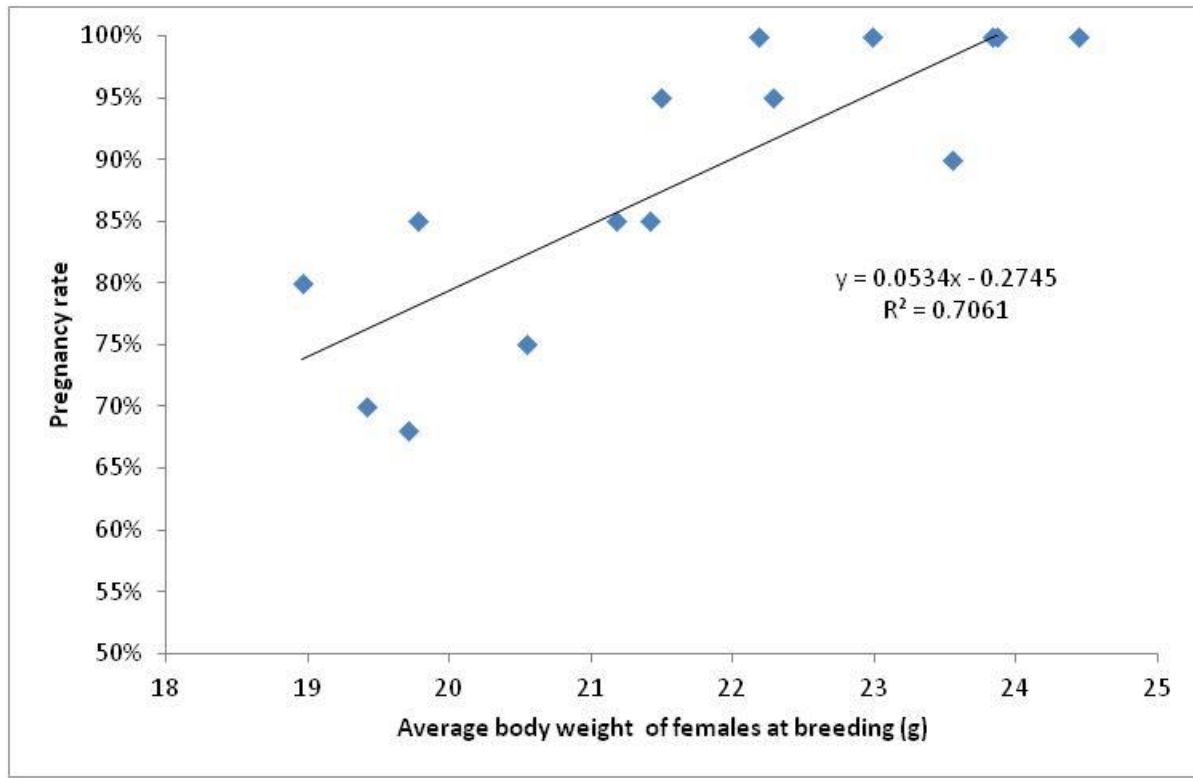


Figure 26: Correlation between body weight at time of breeding and pregnancy rate for females in the first, second and third generations.

As shown in Figure 25, the second generation had the highest pregnancy rates in the control and treatment groups when compared to the pregnancy rates in the first and third generations. The first generation had the lowest pregnancy rates in all of the groups and the third generation had pregnancy rates between the first and second generation rates, with the exception of the 10.0 Bq/L group where both the second and third generations had a 100% pregnancy rate. No detrimental Ra-226 exposure effects were noted within a given generation. Pregnancy rate as a function of female body weight is shown in Figure 26. It seems that pregnancy rate is correlated with the weight of females at breeding time.

6.2 Number of offspring produced per pregnancy in the first, second and third generations

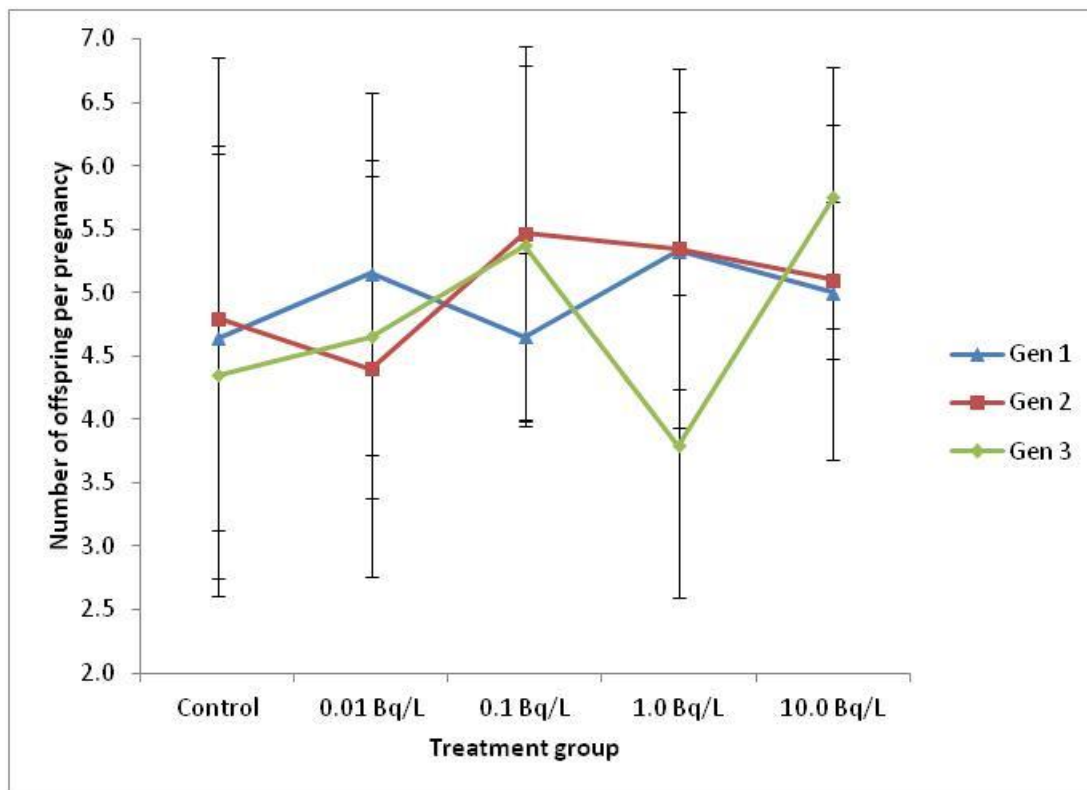


Figure 27: Comparison of number of offspring produced per pregnancy in the first, second and third generations.

Figure 27 displays the number of pups produced per pregnancy in all groups in the 3 parent generations. No statistical significant differences exist due to Ra-226 and no marked differences between generations were observed.

6.3 Gender ratios of the offspring born in the second, third and fourth generations

Figure 28 provides a comparison of the males and females born in the control and treatment groups in the second, third and fourth generations. These data were presented individually in AECL report 153-121241-REPT-017.

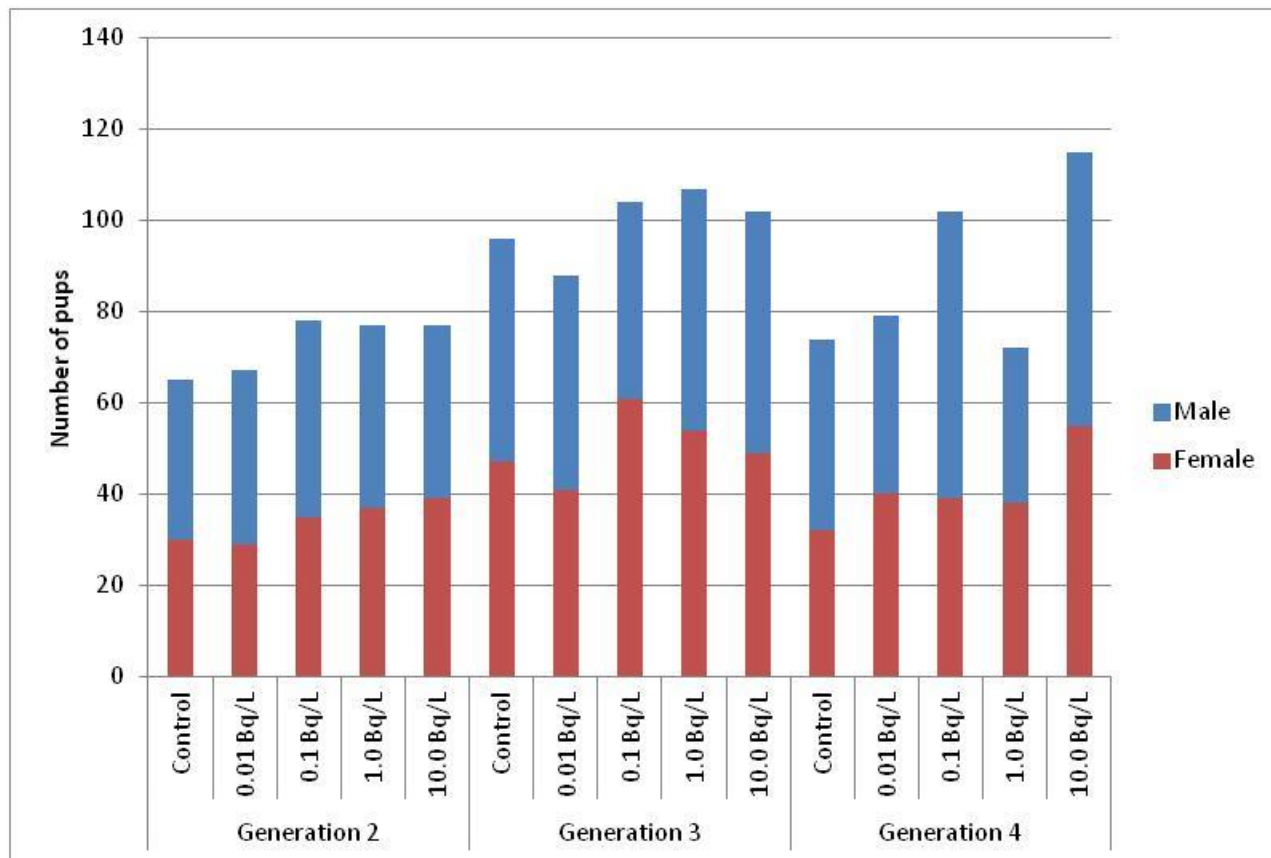


Figure 28: Comparison of the number of offspring (male and female) born in the second, third and fourth generations.

In Figure 28, the females were placed at the bottom to allow for an easier comparison between treatment groups and between generations. This was done because in wild populations, the number of females has a larger influence on the populations than the number of males. It was noticed that the number of generation 2 pups was lower compared to the number of pups born in generation 3. This lower number of pups seemed to have allowed mice from generation 2 to accumulate more fat later in life (Section 5.2) compared to generation 3 mice. Generally, in a given generation, the number of pups and therefore the number of females produced was higher in exposed groups compared to the control group. Such differences were not, however, significantly different. No decrease in the number of pups was noted in subsequent generations.

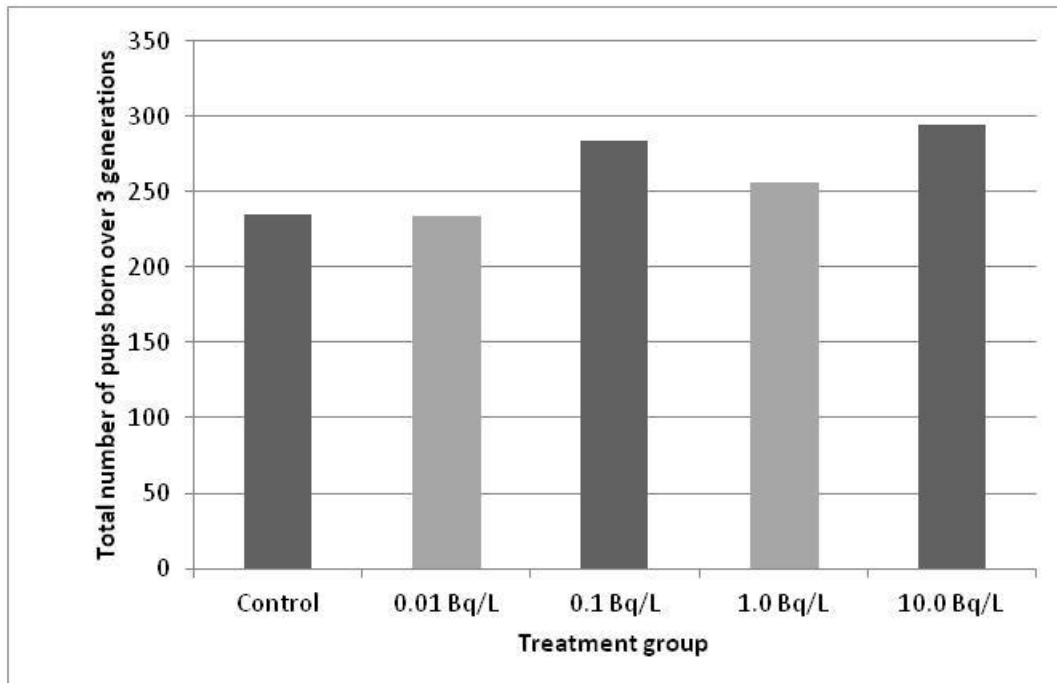


Figure 29: Comparison of the total number of pups born in the control and treatment groups over 3 generations.

Figure 29 shows that overall there is a trend for an increase in the number of pups born in groups exposed to Ra-226 compared to controls. However, the differences are not statistically significant.

7. ORGAN DATA

At various time points (Table 1) mice of specific generations and ages were euthanized and organ samples were collected for weight measurements. In the proceeding subsections, organ data collected from mice at 6 weeks of age is compared between generations and genders. In addition, organ measurements from extra mice after weaning and the experimental mice euthanized at the end of the study are displayed in Figures 42 – 74.

7.1 Comparison of organ data collected from mice at 6 weeks of age

Figures 30 – 37 display the weights of gonads, kidneys, liver and spleen as a proportion of body weight and Figures 38 – 41 show the weights of heart and brain tissues for second, third and fourth generation mice (males and females) dissected at 6 weeks of age. Because heart and brain weights are less influenced by body weight compared to the other organs examined, weights of these organs were compared directly. These measurements were obtained from the same mice as Section 5.3. Refer to AECL reports 153-121241-REPT-014, 153-121241-REPT-017 and 153-121241-REPT-018 for greater detail.

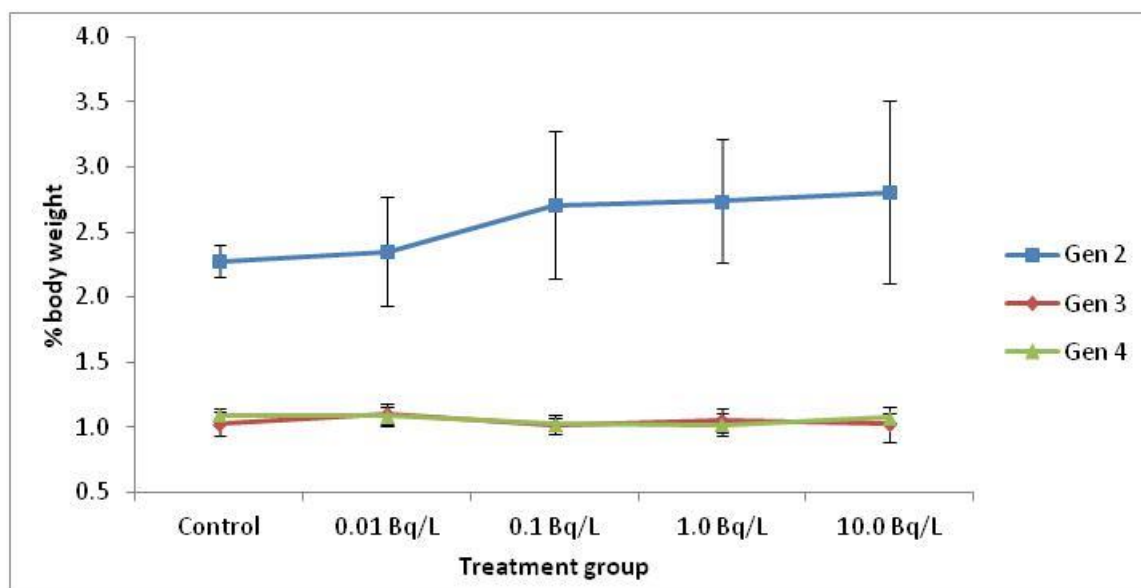


Figure 30: Comparison of weights of gonads as proportion of body weight between the first, second and third generation males at 6 weeks of age.

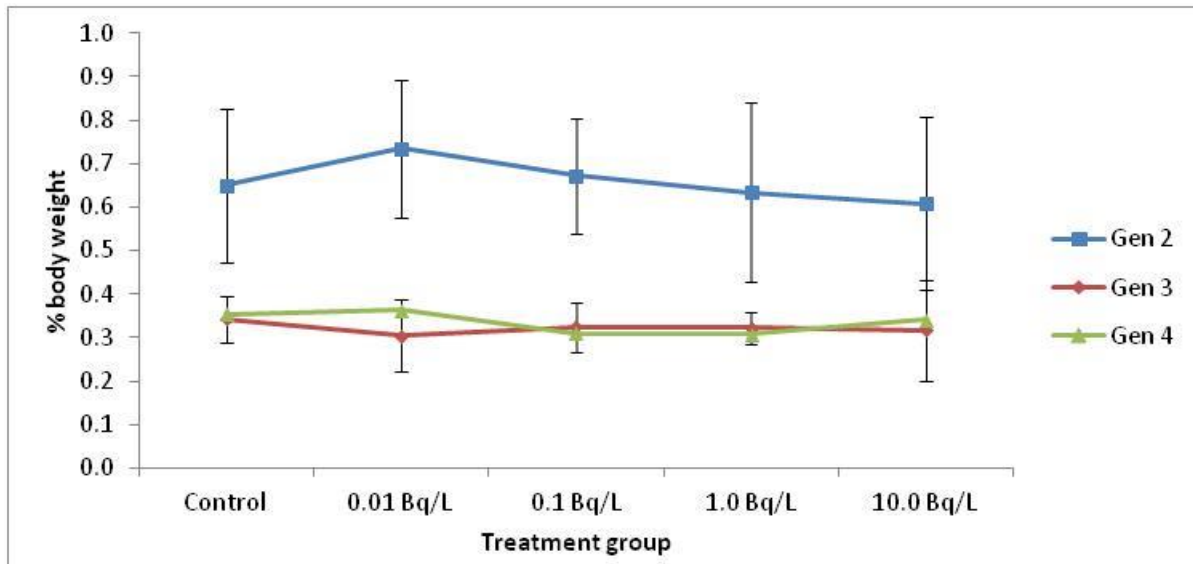


Figure 31: Comparison weights of gonads as proportion of body weight between the first, second and third generation females at 6 weeks of age.

Generation 2 mice had a tendency to be heavier compared to the other generations of mice and had significantly more fat associated with their reproductive organs. Treatment mice in this generation also had the highest pregnancy rate (Figure 25). No differences can be attributed to Ra-226 exposure.

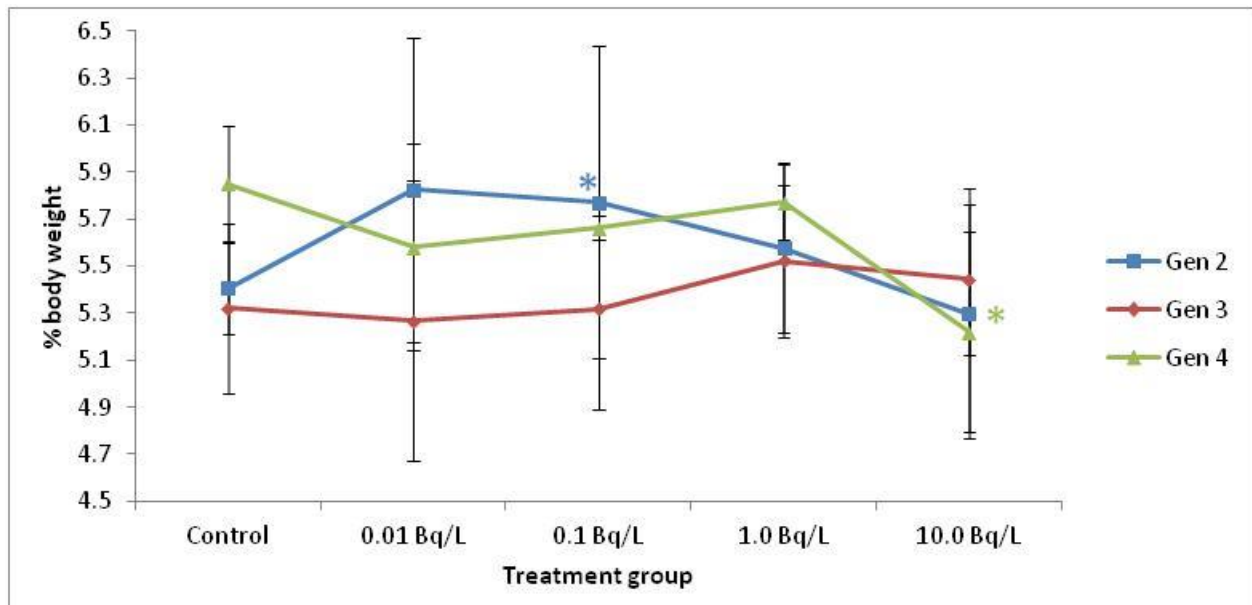


Figure 32: Comparison weights of liver as proportion of body weight between the first, second and third generation males at 6 weeks of age. * Indicates statistical difference from corresponding control.

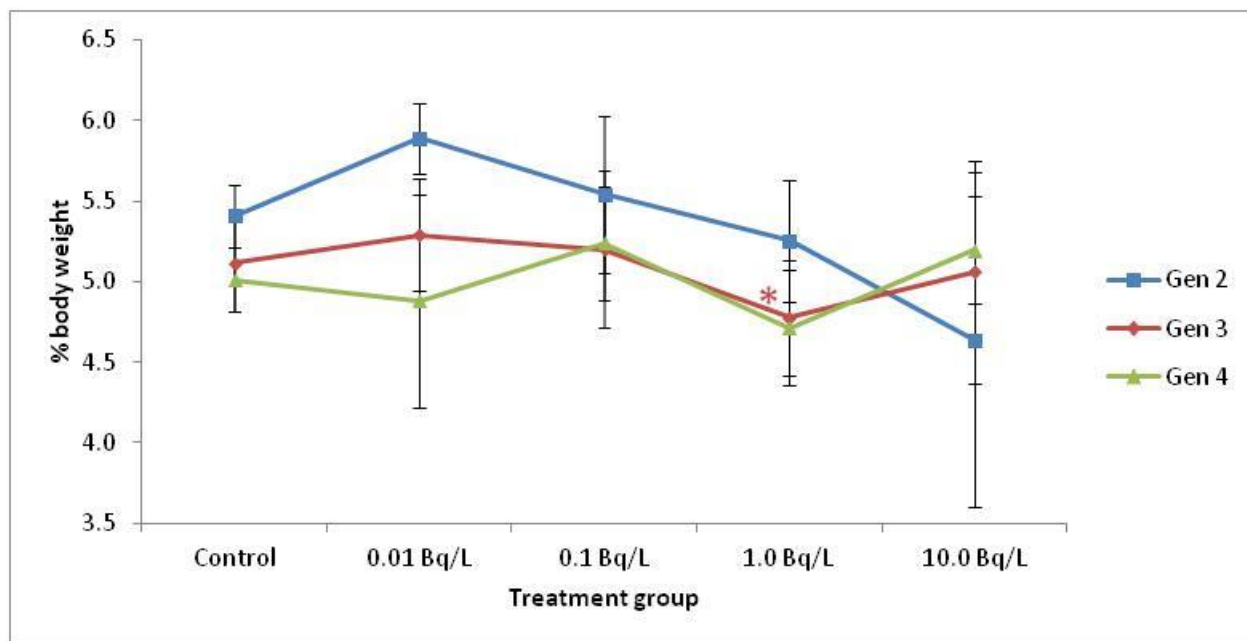


Figure 33: Comparison of weights of liver as proportion of body weight between the first, second and third generation females at 6 weeks of age. * Indicates statistical difference from corresponding control.

No inter-generational consistent significant differences between test groups and controls were noted. There did not seem to be an effect of Ra-226 exposure on liver weight.

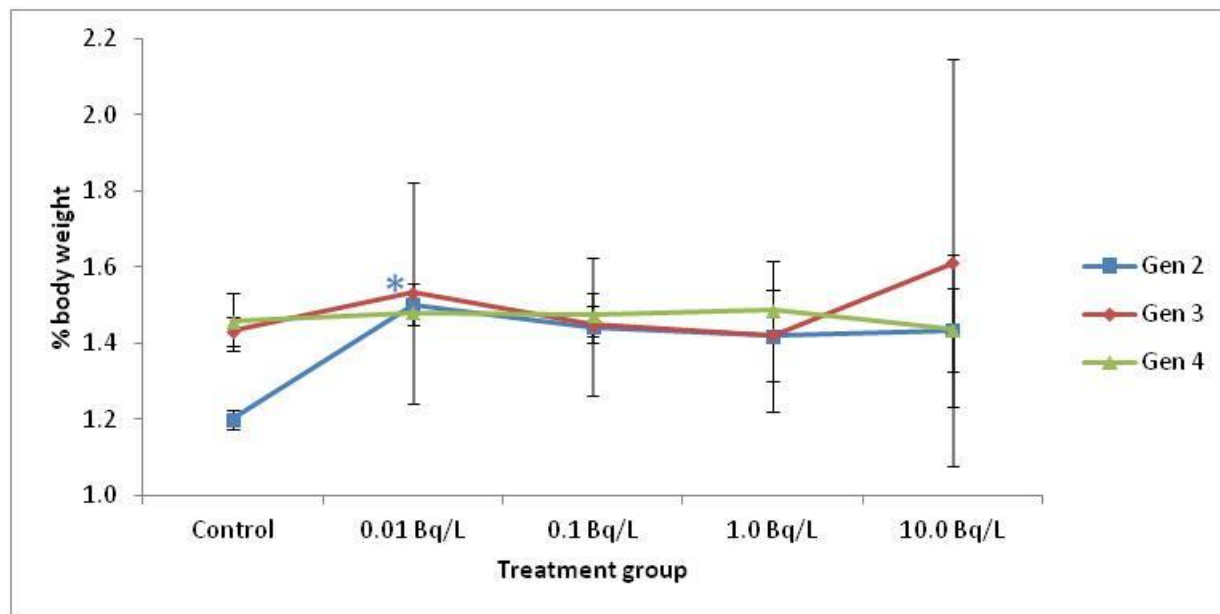


Figure 34: Comparison of weights of kidneys as proportion of body weight between the first, second and third generation males at 6 weeks of age. * Indicates statistical difference from corresponding control.

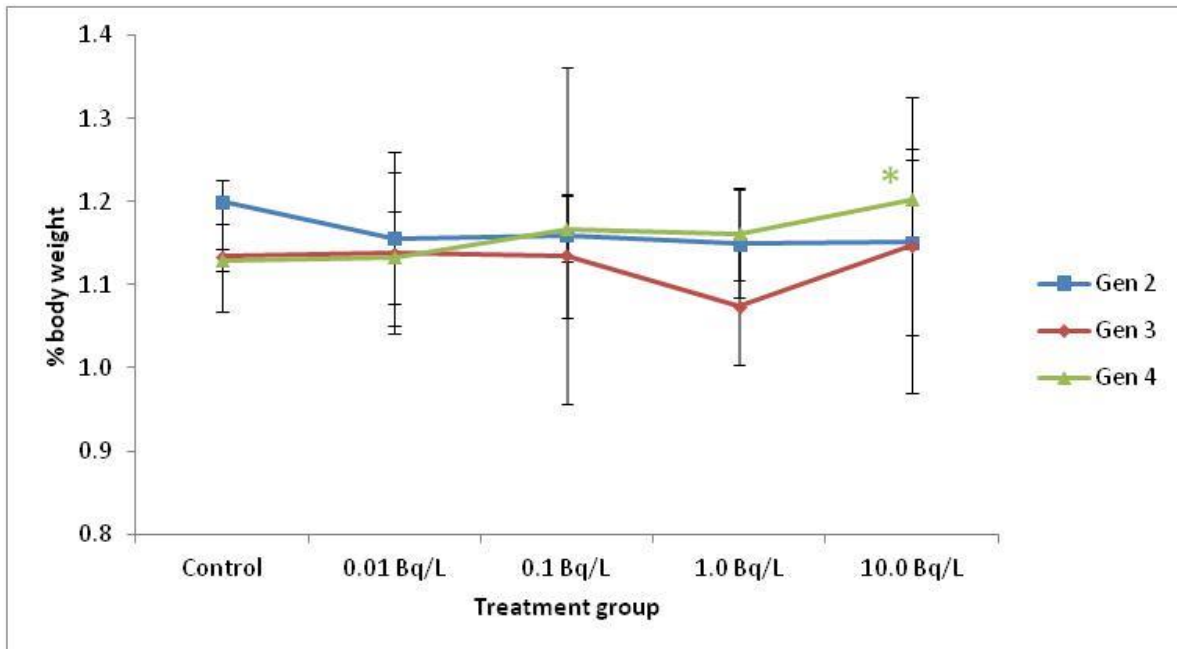


Figure 35: Comparison of weights of kidney as proportion of body weight between the first, second and third generation females at 6 weeks of age. * Indicates statistical difference from corresponding control.

No consistent statistical differences were observed with kidney weights between treatment groups and generations. Ra-226 exposure did not seem to have an effect on the weight of kidneys.

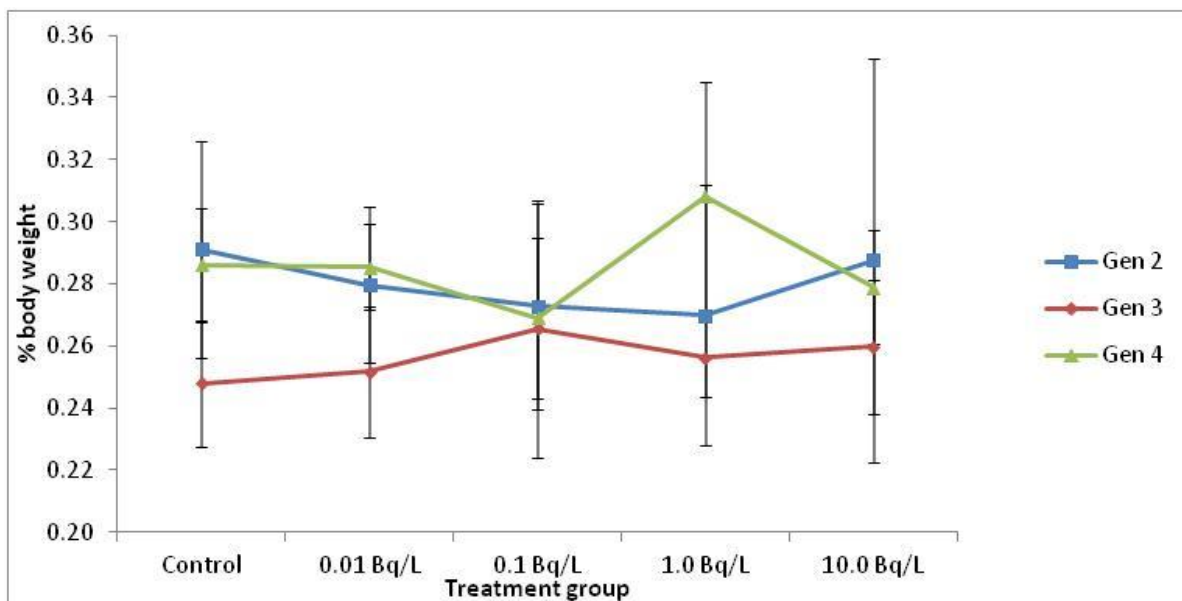


Figure 36: Comparison of weights of spleen as proportion of body weight between the first, second and third generation males at 6 weeks of age.

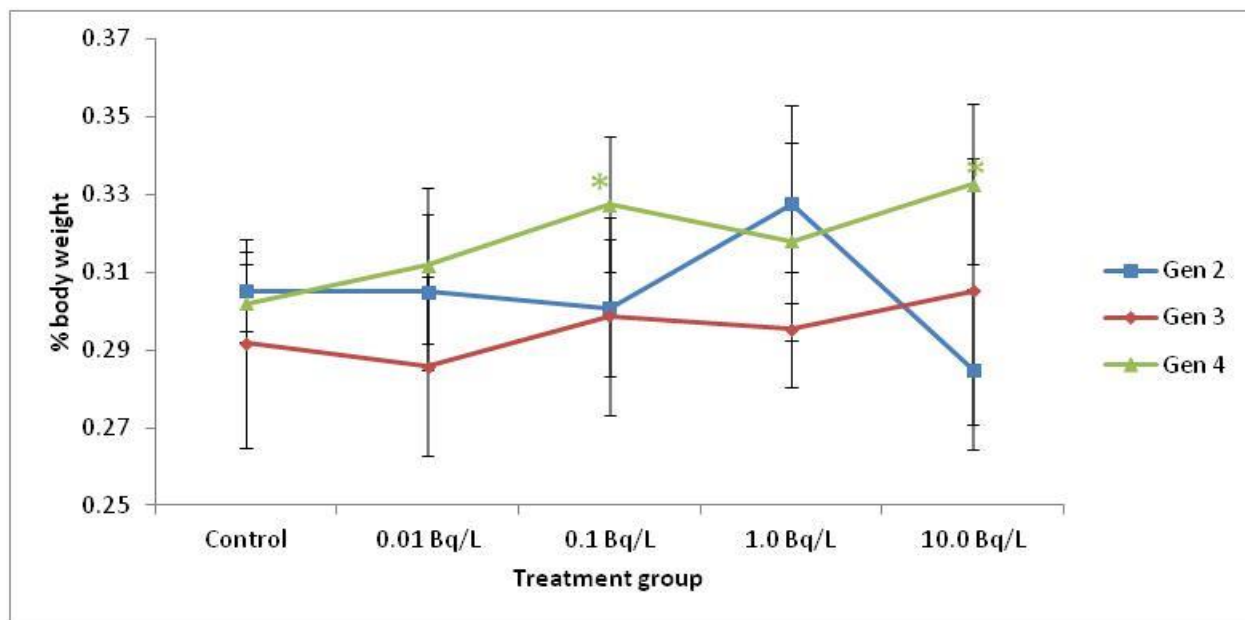


Figure 37: Comparison of weights of spleen as proportion of body weight between the first, second and third generation females at 6 weeks of age. * Indicates statistical difference from corresponding control.

No consistent significant differences existed among spleen weights. Ra-226 exposure did not seem to correlate with this measurement.

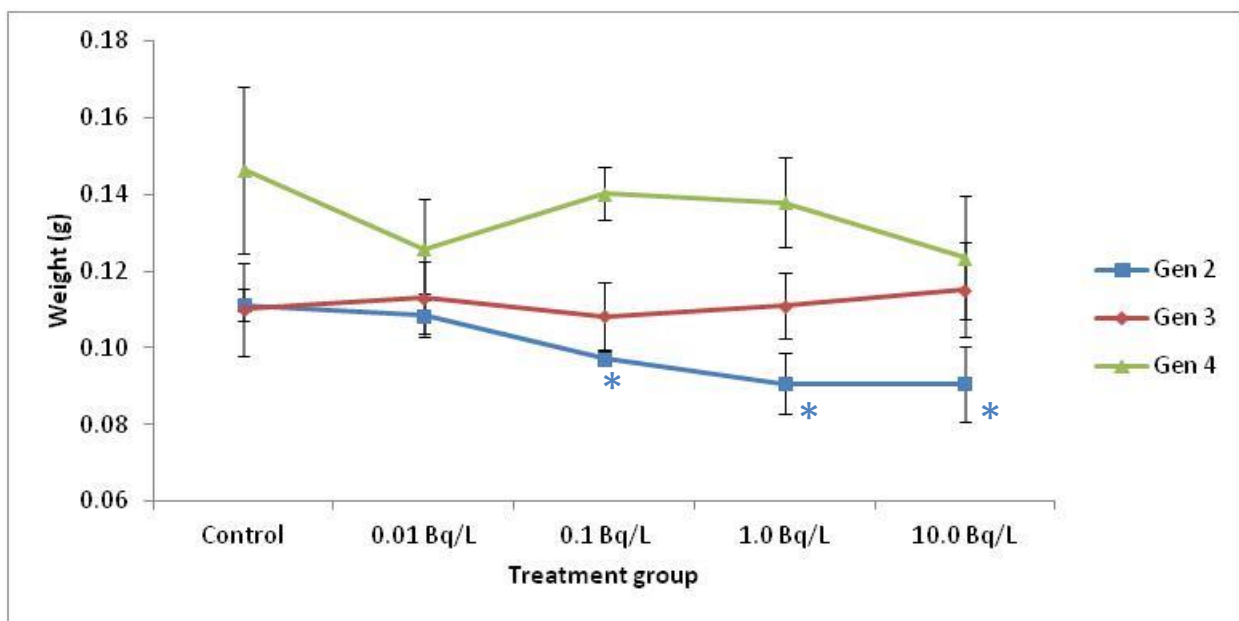


Figure 38: Comparison of weight of heart tissues between the first, second and third generation males at 6 weeks of age. * Indicates statistical difference from corresponding control.

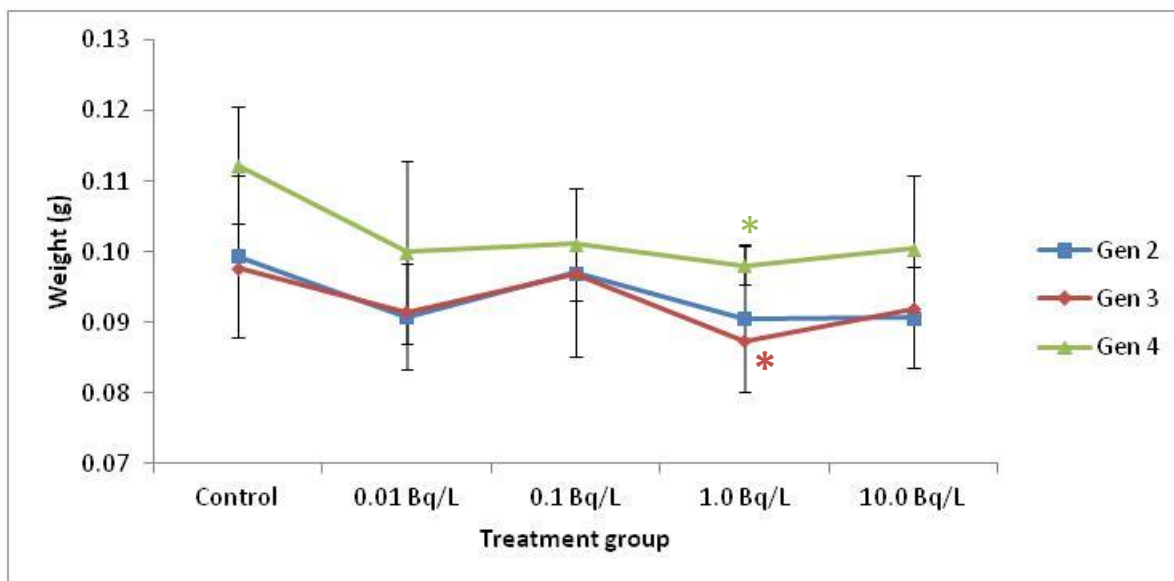


Figure 39: Comparison of weight of heart tissues between the first, second and third generation females at 6 weeks of age. * Indicates statistical difference from corresponding control.

Differences were noted for the generation 2 males (0.1, 1.0, 10.0 Bq/L) and the 1.0 Bq/L female groups in generations 2 and 4.

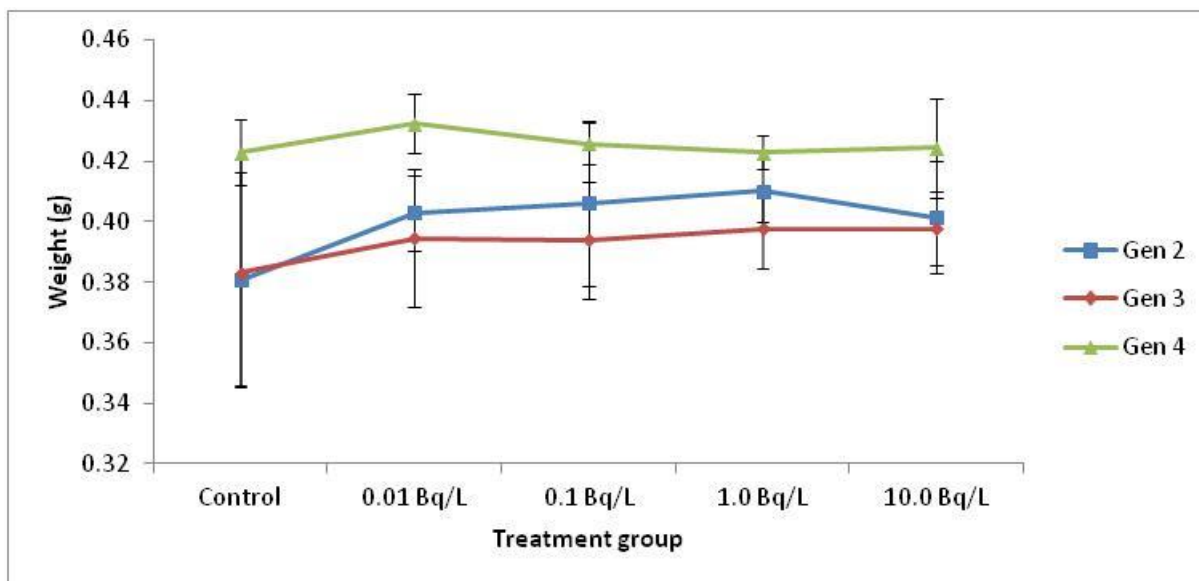


Figure 40: Comparison of weight of brain tissues between the first, second and third generation males at 6 weeks of age.

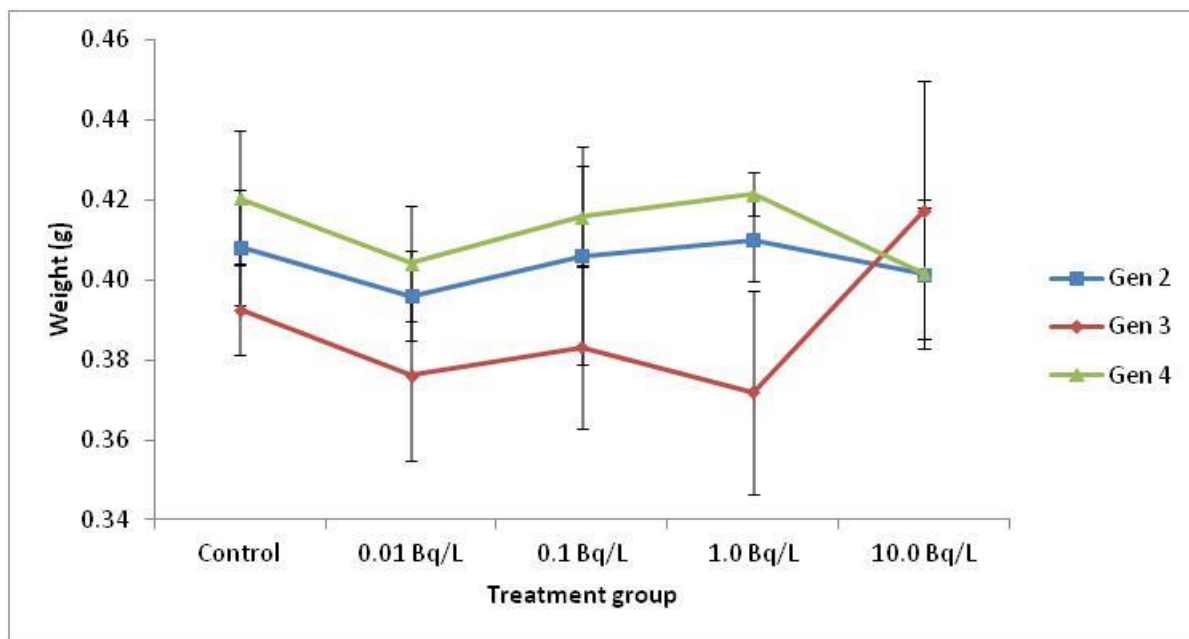


Figure 41: Comparison of weight of brain tissues between the first, second and third generation females at 6 weeks of age.

There were no statistically significant differences noted when comparing control brain weights to test groups in all generations examined.

7.2 Comparison of organ weights of first generation mice at 35-37 weeks of age

Figures 42 - 46 show the tissue data collected from 10 first generation mice (5 males and 5 females) in each group. Males euthanized at this time point would have consumed approximately 687 mL of water and the females would have consumed about 624 mL. Refer to Appendix B for the raw data.

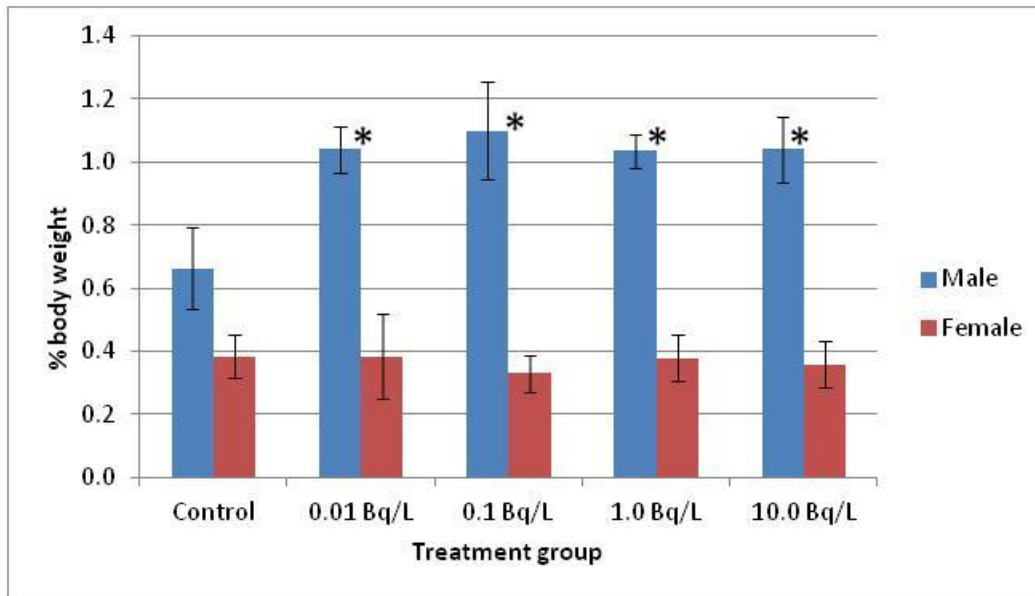


Figure 42: Weights of gonads as proportion of body weight for the first generation at 35-37 weeks of age. * Indicates statistical difference from control.

Males in the 4 treatment groups (0.01 Bq/L (t-test, $p=0.007$), 0.1 Bq/L (t-test, $p=0.012$), 1.0 Bq/L (t-test, $p=0.006$) and 10.0 Bq/L (t-test, $p=0.001$)) had statistically significant greater proportions of gonad weights to body weights when compared to the controls. The females showed no significant differences between the control and treatment groups.

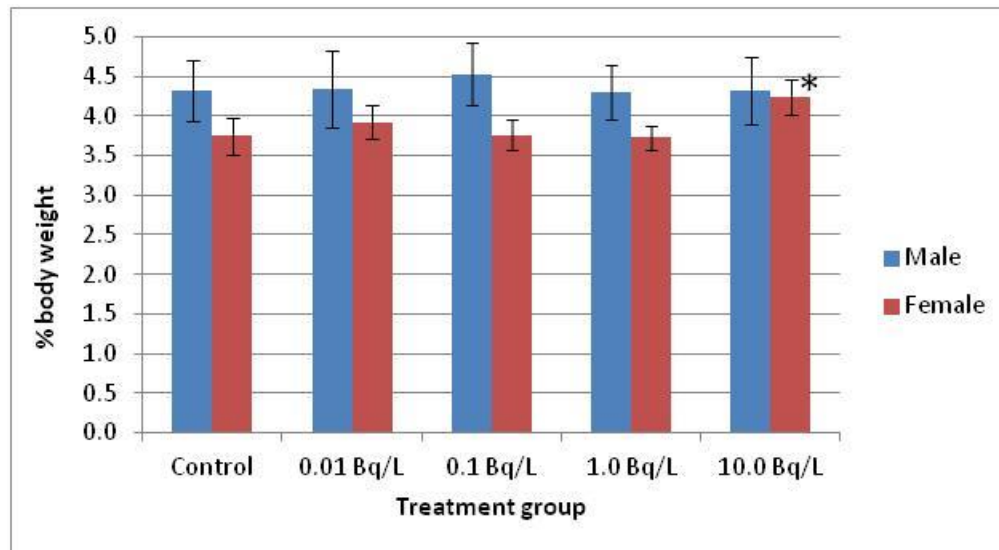


Figure 43: Weights of liver as proportion of body weight for the first generation at 35-37 weeks of age. * Indicates statistical difference from control.

Females in the 10.0 Bq/L treatment group (t-test, $p=0.042$) had significantly greater proportions of liver weights to body weights compared to the control. No other significant differences were noted.

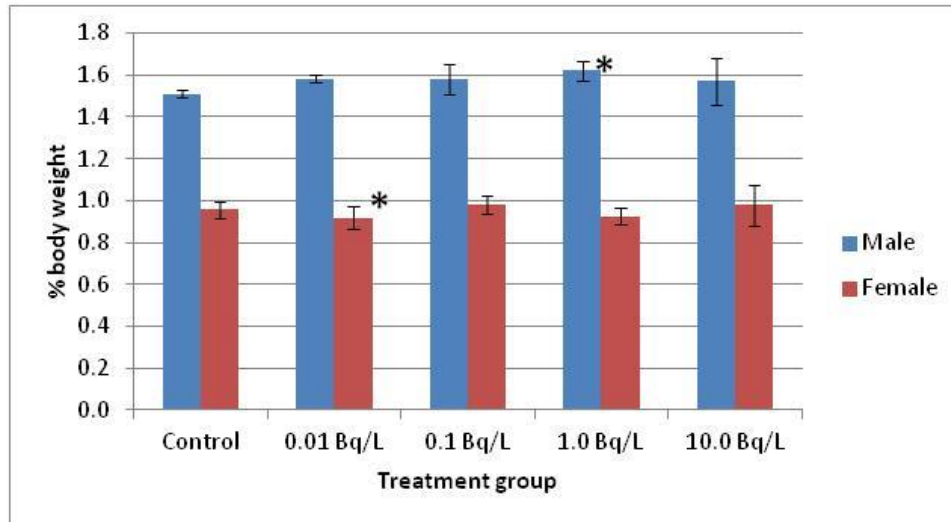


Figure 44: Weights of kidney as proportion of body weight for the first generation at 35-37 weeks of age. * Indicates statistical difference from control.

A significantly greater proportion of kidney weight to body weight was noted between the control and 1.0 Bq/L male group (t-test, $p=0.001$). For the females, significantly smaller proportions of kidney weight to body weight existed between the control and 0.01 Bq/L group (t-test, $p=0.016$).

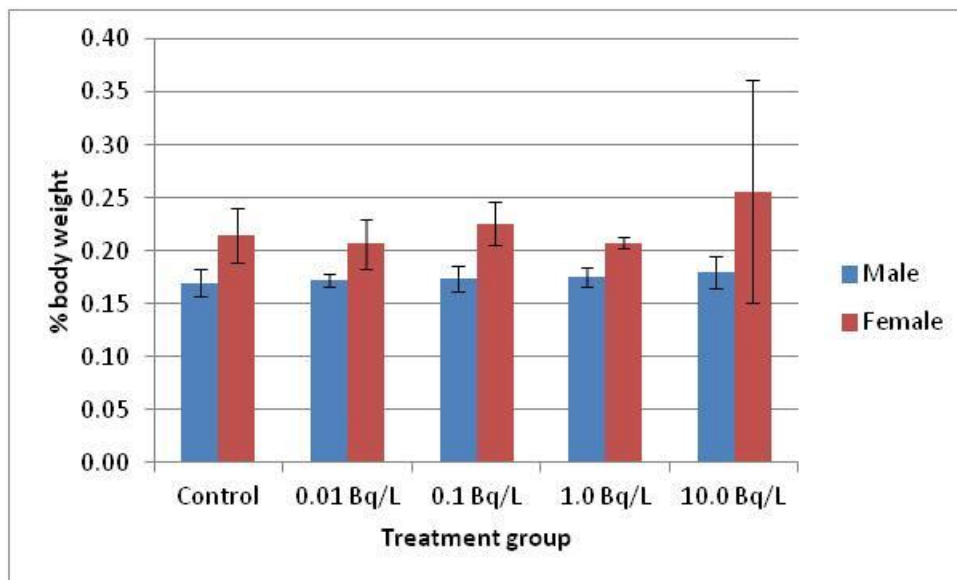


Figure 45: Weight of spleen as proportion of body weight for the first generation at 35-37 weeks of age.

No significant differences existed between the control and treatment groups for males and females.

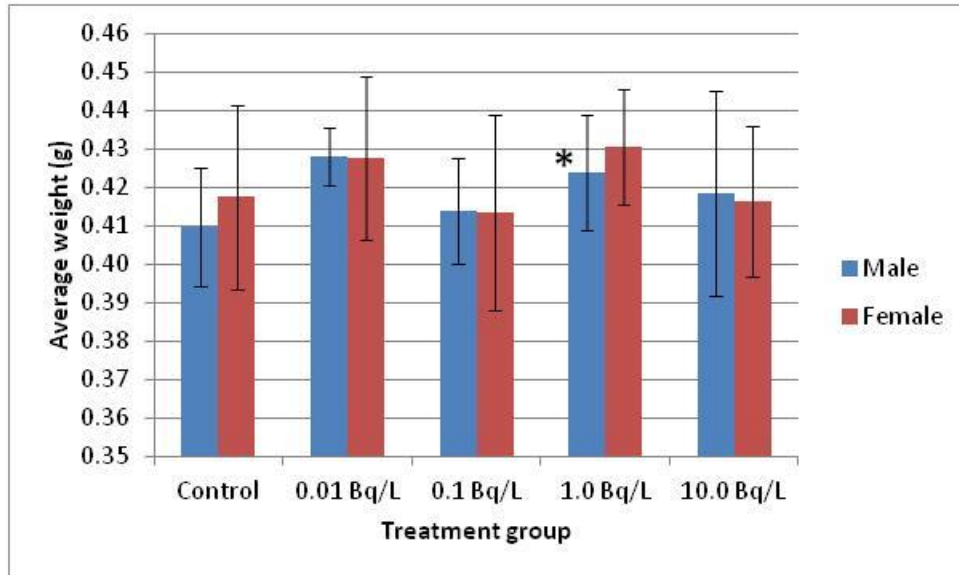


Figure 46: Weights of brain for the first generation at 35-37 weeks of age. * Indicates statistical difference from control.

For males, brain weights in the 1.0 Bq/L group (t-test, $p=0.016$) were significantly greater than the control. No other differences were observed.

7.3 Comparison of organ weights of second generation mice at 7 and 25 weeks of age

At 7 weeks of age, 100 second generation mice (13 males and 5 females in the 0.01 Bq/L group; 18 males and 10 females in the 0.1 Bq/L group; 15 males and 12 females in the 1.0 Bq/L group; and 13 males and 14 females in the 10.0 Bq/L group) were dissected and tissue data were collected. A statistical analysis could not be performed on the control and treatment groups because all extra control mice were kept as sentinels for the study. It is estimated that male mice at 7 weeks of age would have consumed about 45.8 mL of water and female mice of the same age would have consumed about 41.6 mL of water. Refer to Appendix B for the raw data.

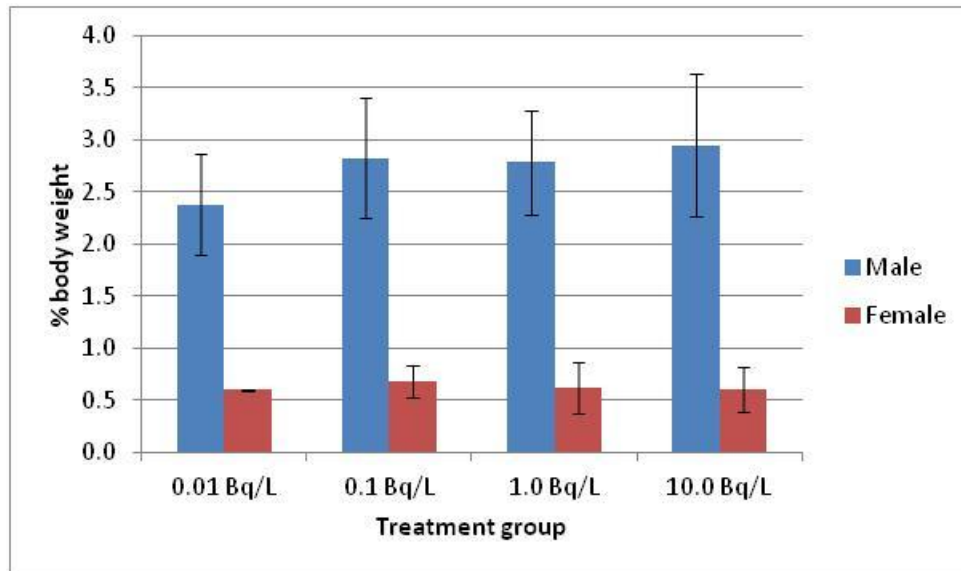


Figure 47: Weights of gonads as proportion of body weight for the second generation at 7 weeks of age.

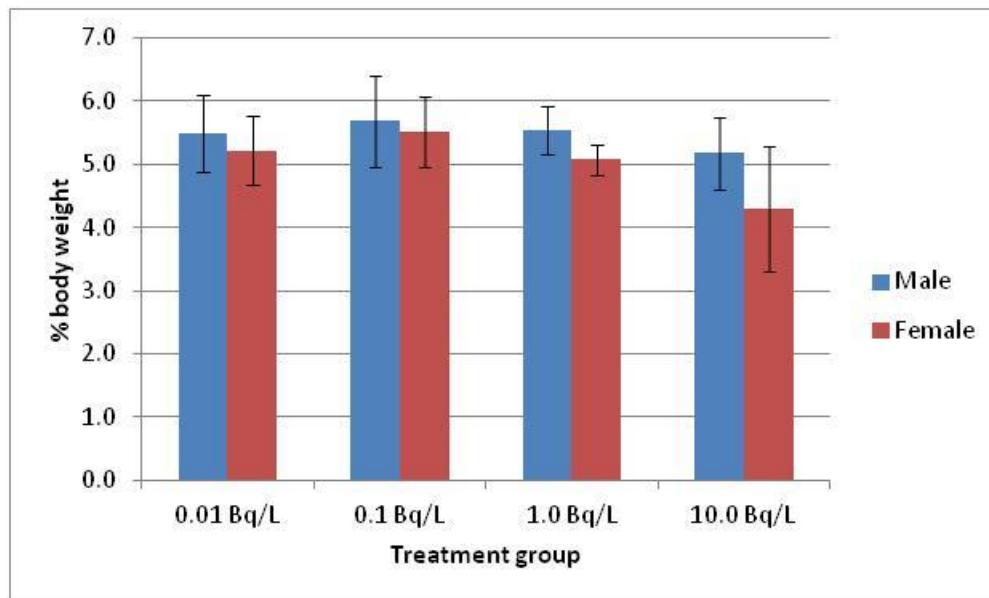


Figure 48: Weights of liver as proportion of body weight for the second generation at 7 weeks of age.

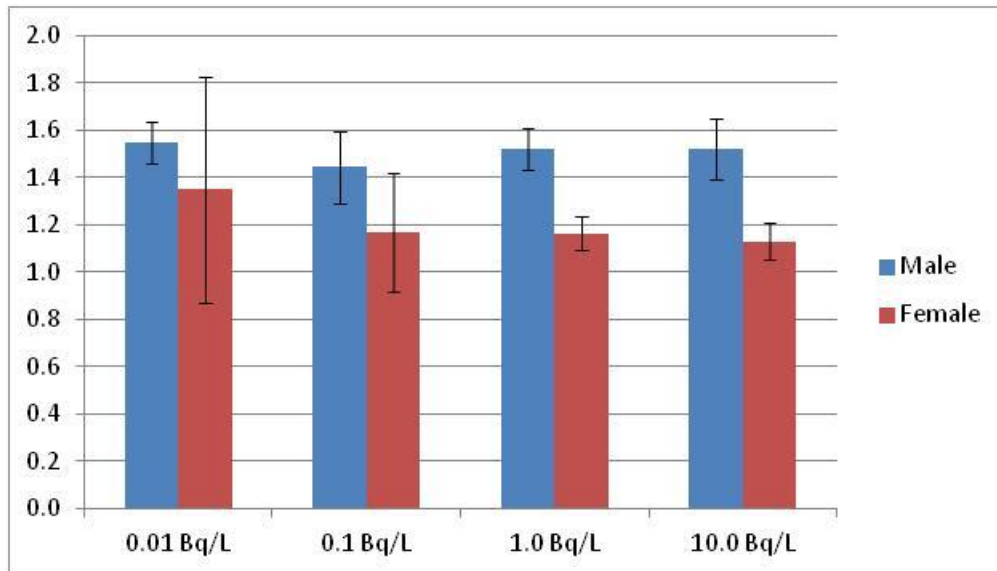


Figure 49: Weights of kidney as proportion of body weight for the second generation at 7 weeks of age.

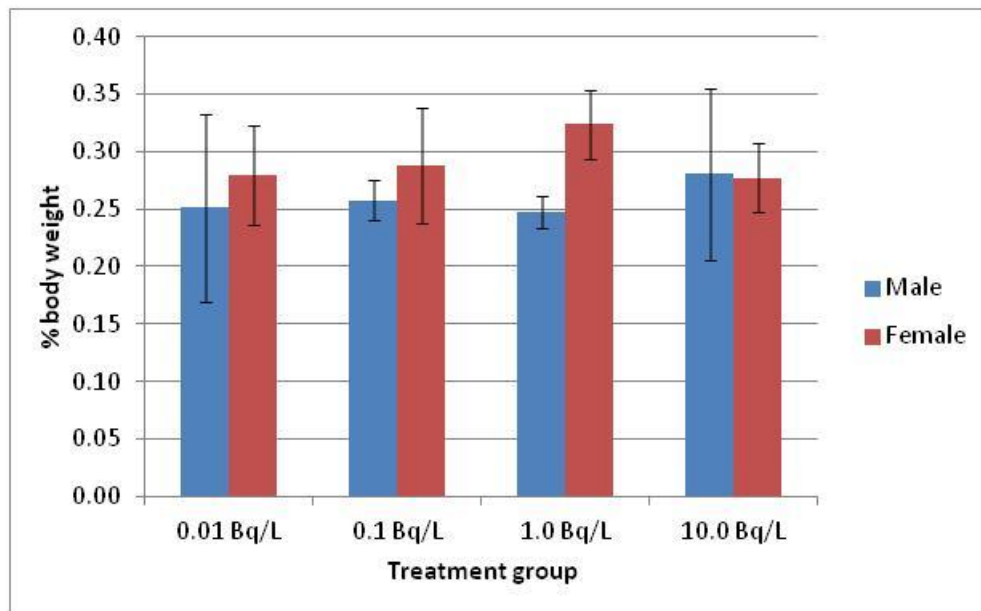


Figure 50: Weights of spleen as proportion of body weight for the second generation at 7 weeks of age.

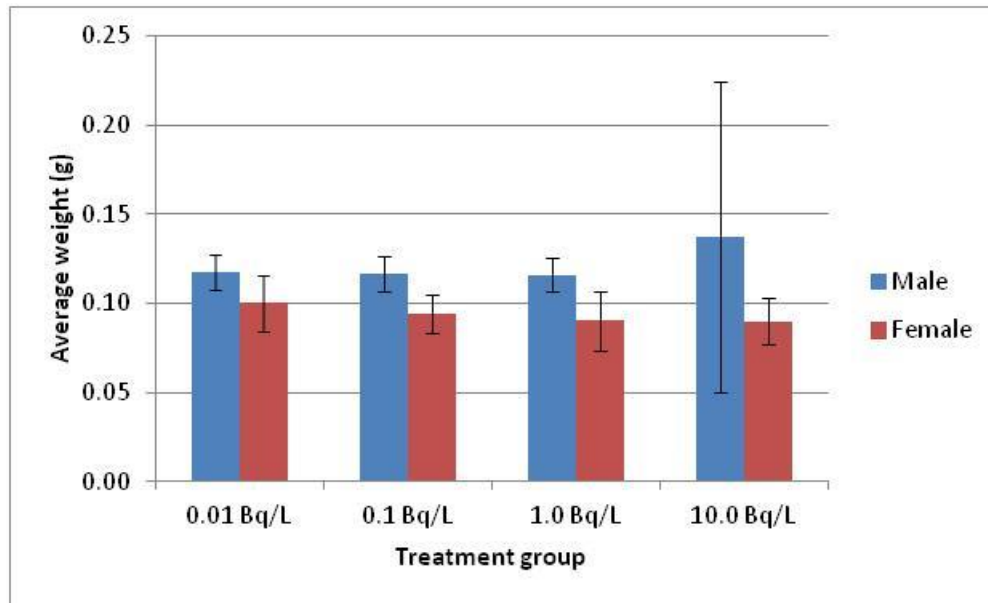


Figure 51: Weights of heart for the second generation at 7 weeks of age.

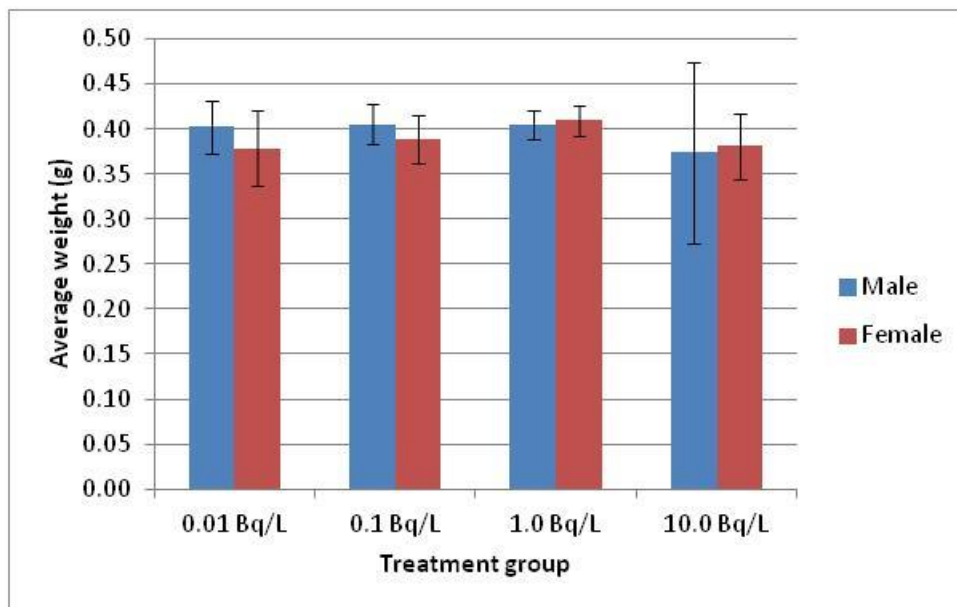


Figure 52: Weights of brain for the second generation at 7 weeks of age.

At 25 weeks of age, 10 mice (5 males and 5 females) from each group in generation 2 were euthanized. The following figures provide an overview of the average proportions and weights of the tissues collected. It is predicted that the male mice consumed approximately 572.3 mL of water and female mice consumed about 520 mL of water. Refer to Appendix B for the raw data.

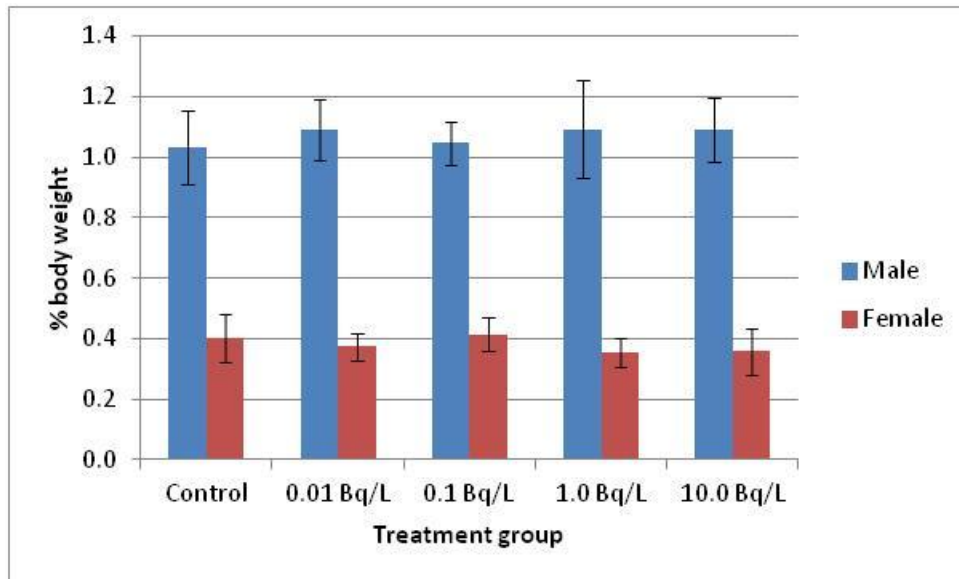


Figure 53: Weights of gonads as proportion of body weight for the second generation at 25 weeks of age.

No statistically significant differences existed for the weights of gonads as a proportion of body weight between the control and treatment groups for both males and females.

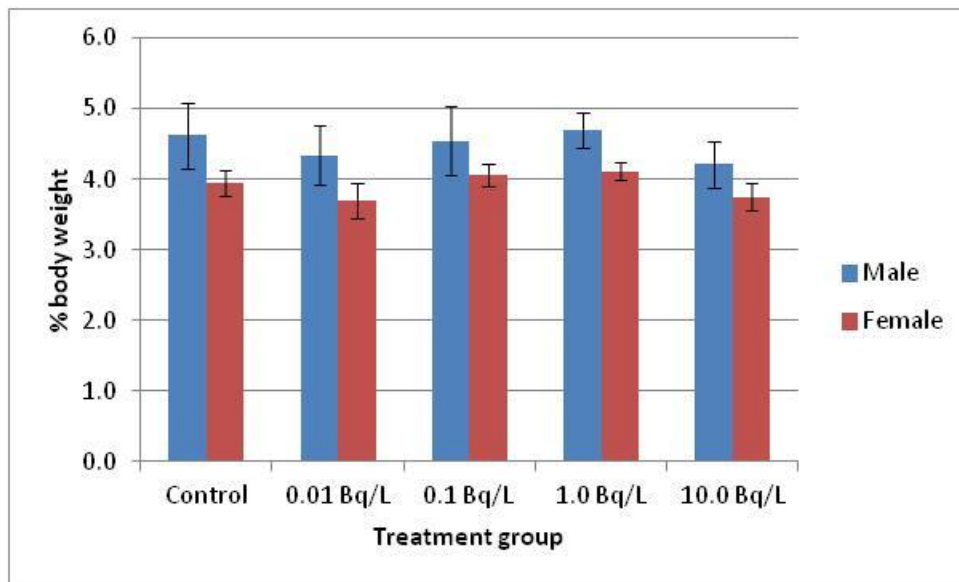


Figure 54: Weights of liver as proportion of body weight for the second generation at 25 weeks of age.

When examining weights of liver as a proportion of body weight, no differences were noted between the control and treatment groups for males and females.

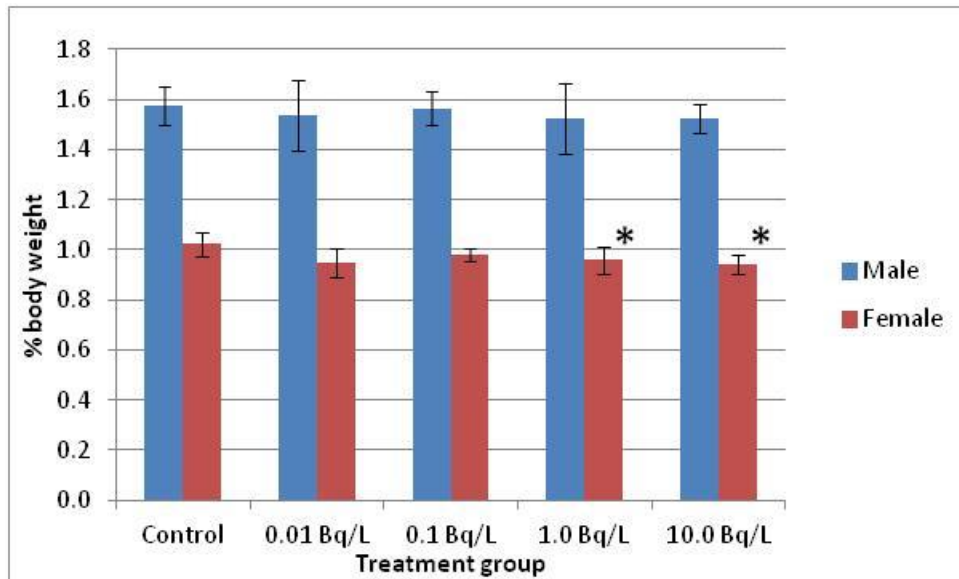


Figure 55: Weights of kidney as proportion of body weight for the second generation at 25 weeks of age. * Indicates statistical difference from control.

For females, proportions of kidney weight to body weight were smaller in the 1.0 Bq/L (t-test, $p=0.032$) and 10.0 Bq/L (t-test, $p=0.023$) groups when compared to the control. No significant differences existed with the males.

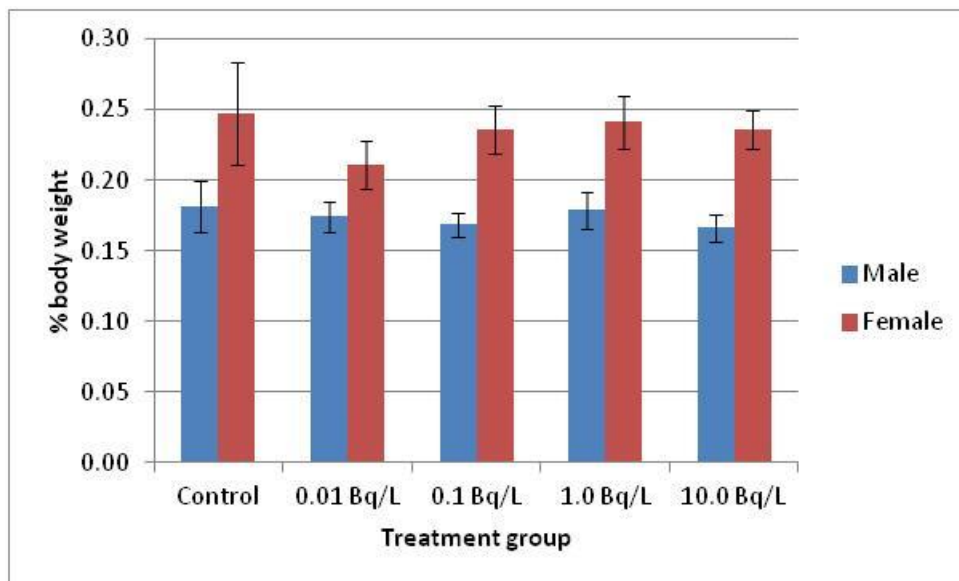


Figure 56: Weights of spleen as proportion of body weight for the second generation at 25 weeks of age.

There were no significant differences observed between the control and treatment groups for both the males and females when comparing the weight of spleens as a proportion of body weight.

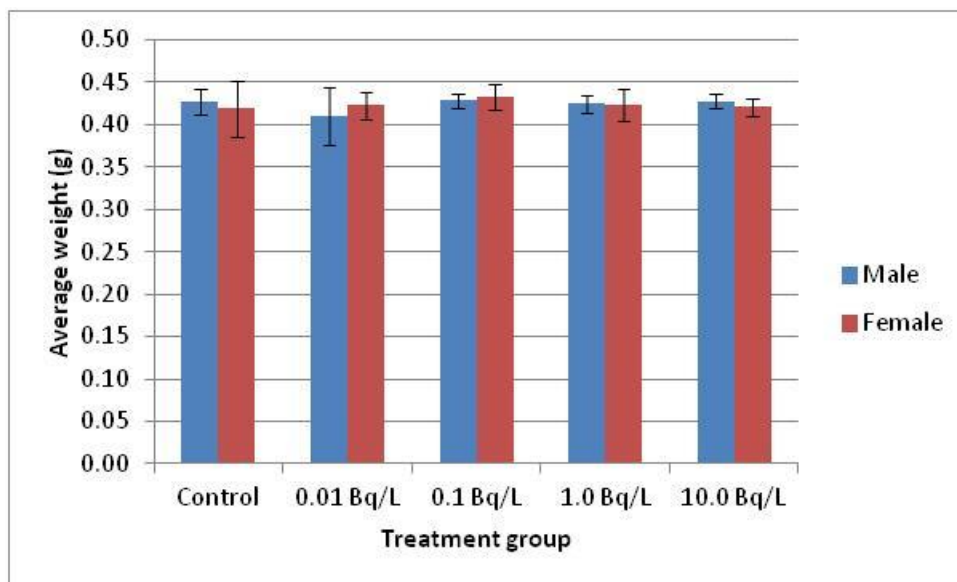


Figure 57: Weights of brain for the second generation at 25 weeks of age.

When comparing brain weights for both males and females, no significant differences existed.

7.4 Comparison of organ weights of third generation mice at 5 and 15 weeks of age

At 5 weeks of age, 50 mice (5 males and 5 females in each group) from the third generation were euthanized. It is estimated that 114 mL and 104 mL of water were consumed by males and females at this age, respectively. Refer to Appendix B for the raw data.

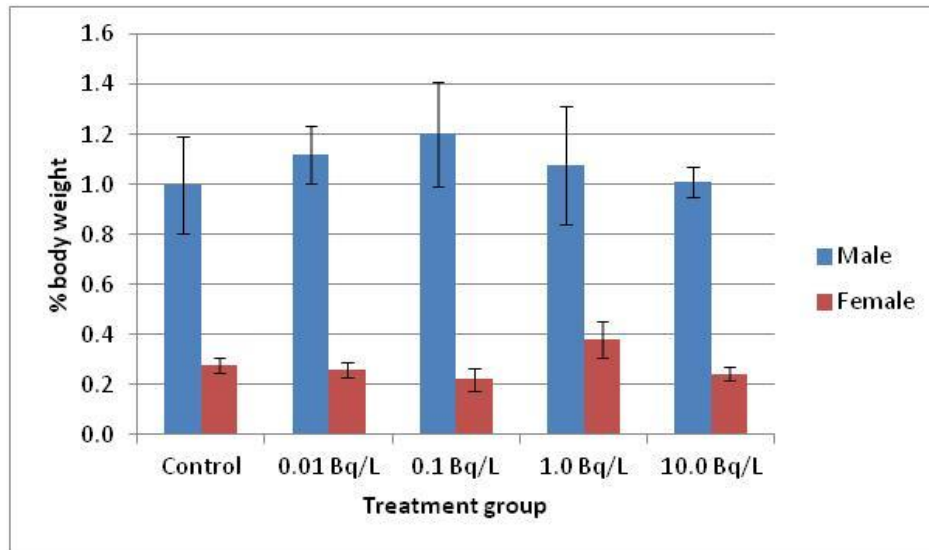


Figure 58: Weights of gonads as proportion of body weight for the third generation at 5 weeks of age.

No differences were observed when comparing the weights of gonads as a proportion of body weight for both males and females.

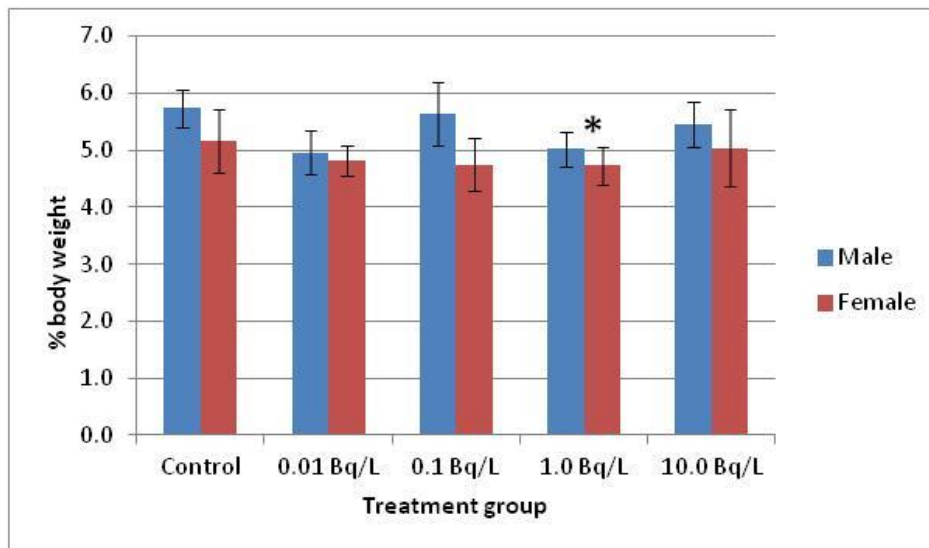


Figure 59: Weights of liver as proportion of body weight for the third generation at 5 weeks of age. * Indicates statistical difference from control.

For males, the proportion of liver weight to body weight was smaller in the 1.0 Bq/L group (t-test, $p=0.008$) compared to the control group. No significant differences existed with the females.

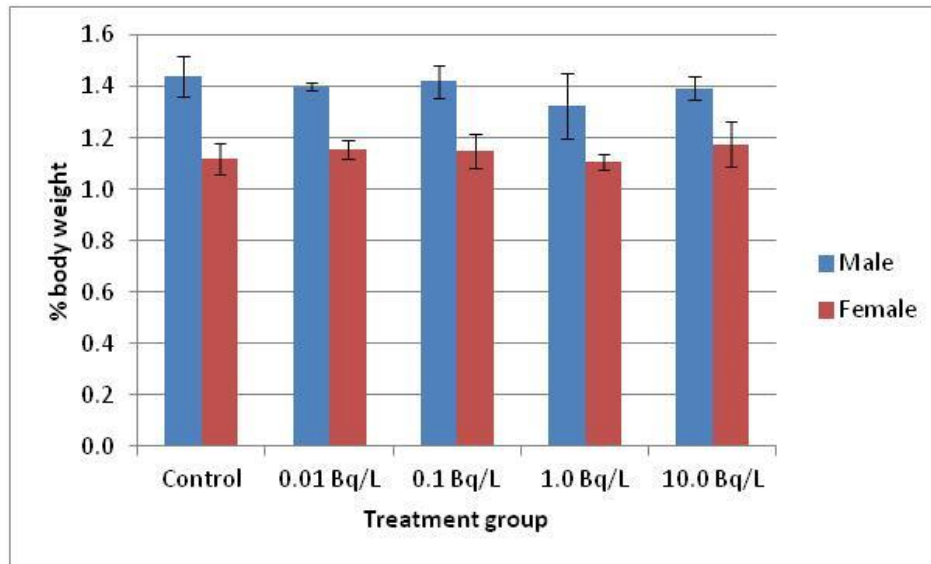


Figure 60: Weights of kidney as proportion of body weight for the third generation at 5 weeks of age.

No differences were observed with kidney proportions between the control and treatment groups for both males and females.

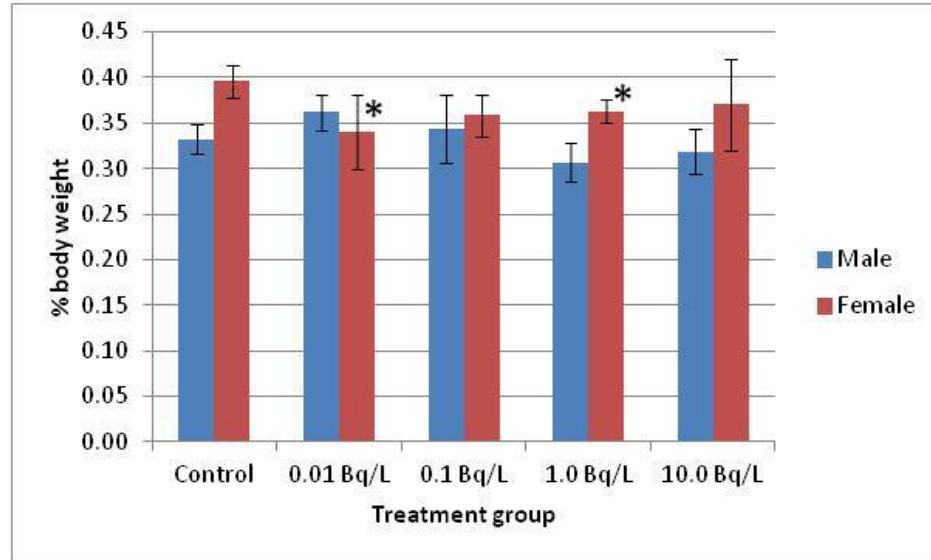


Figure 61: Weights of spleen as proportion of body weight for the third generation at 5 weeks of age. * Indicates statistical difference from control.

The control females had higher proportions of spleen weight to body weight compared to the 0.01 Bq/L (t-test, $p=0.018$) and 1.0 Bq/L (t-test, $p=0.04$) groups. No significant differences were noted with the males.

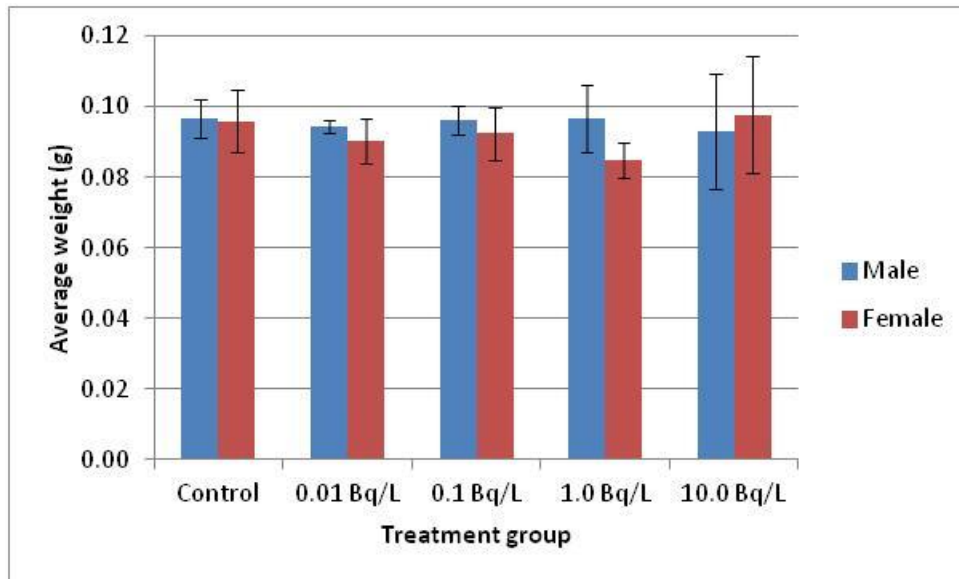


Figure 62: Weights of heart for the third generation at 5 weeks of age.

No differences were noted when comparing heart weights.

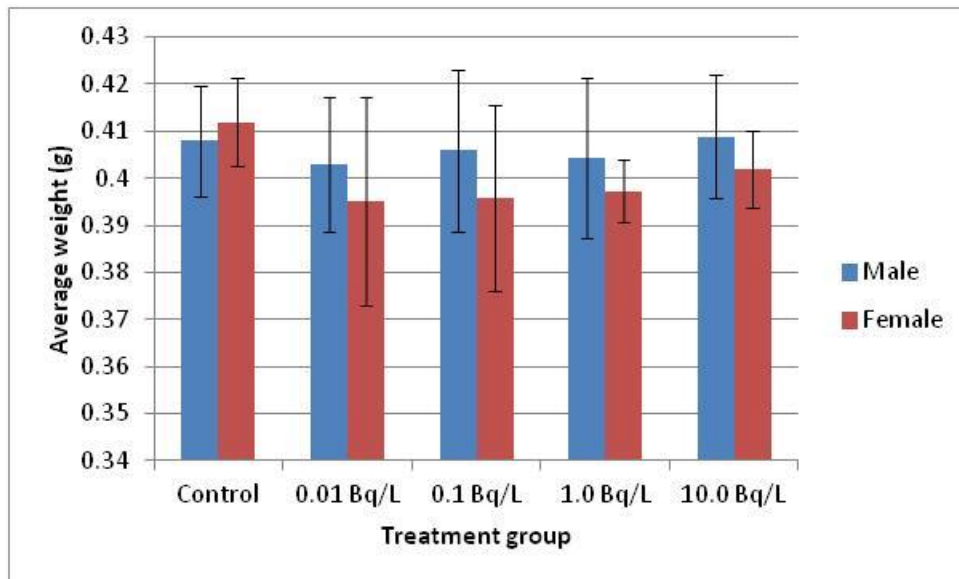


Figure 63: Weights of brain for the third generation at 5 weeks of age.

No statistically significant differences were noted with male or females when looking at brain weights in the control and treatment groups.

Figures 64 – 68 display proportions and weights of tissues collected from 10 mice (5 males and 5 females) in each group at 15 weeks of age. These mice on average consumed 343 mL (males) and 312 mL (females) of water. Refer to Appendix B for the raw data.

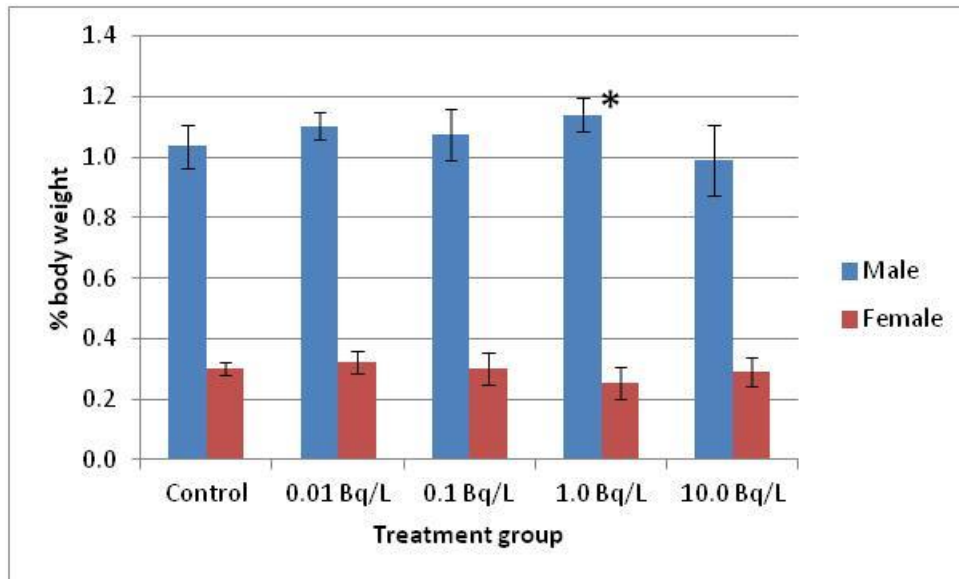


Figure 64: Weights of gonads as proportion of body weight for the third generation at 15 weeks of age. * Indicates statistical difference from control.

Males in the 1.0 Bq/L group (t-test, $p=0.030$) had significantly higher proportions of gonads weight to body weight when compared to males in the control groups. No differences existed with the females.

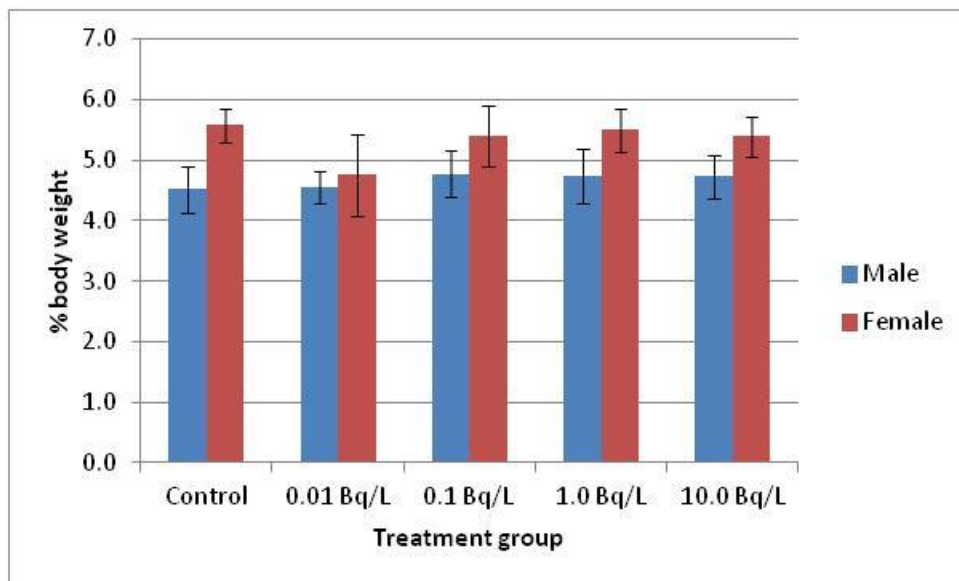


Figure 65: Weights of liver as proportion of body weight for the third generation at 15 weeks of age.

No differences were noted with proportions of liver weight to body weight for both the males and females.

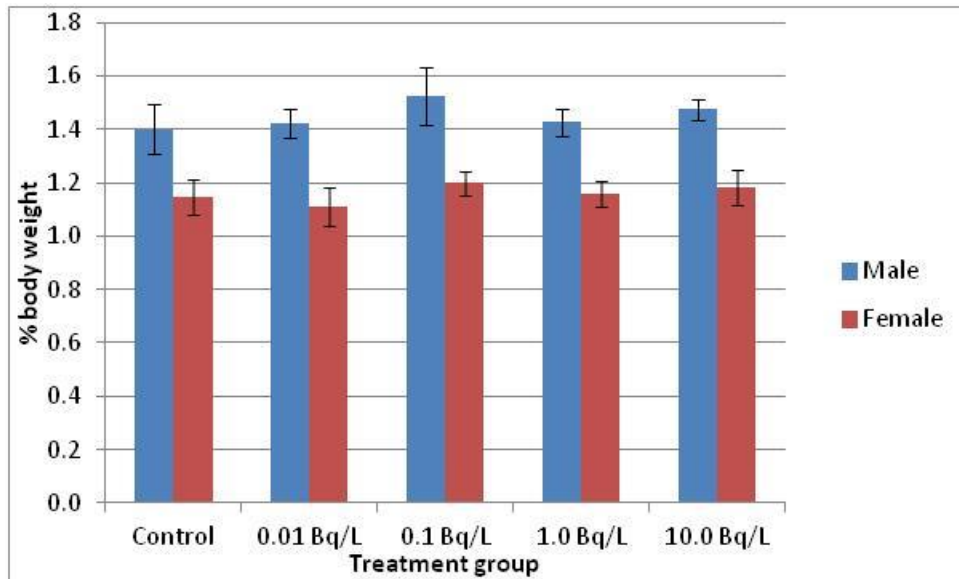


Figure 66: Weights of kidney as proportion of body weight for the third generation at 15 weeks of age.

Proportions of kidney weight to body weight showed no significant differences between control and treatment groups for both male and female mice.

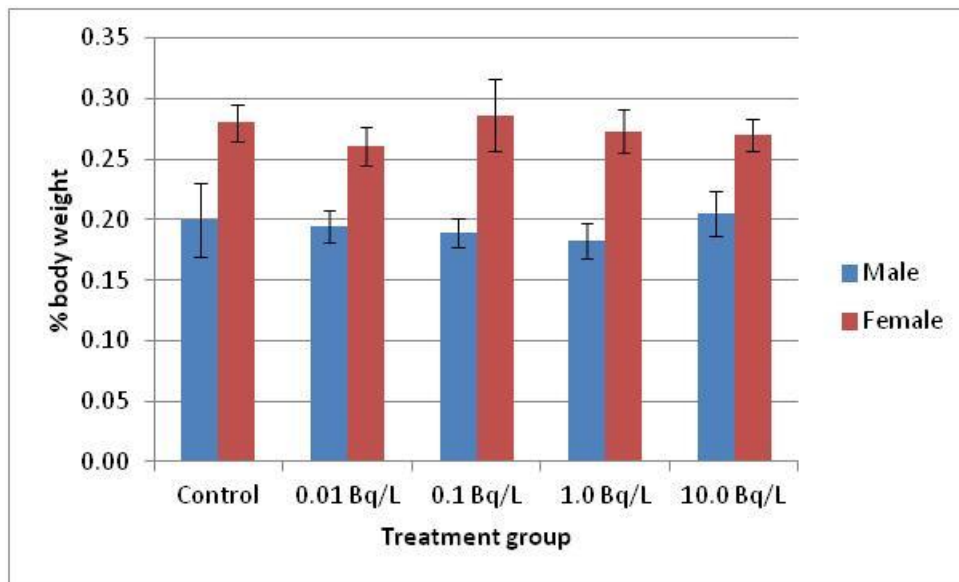


Figure 67: Weights of spleen as proportion of body weight for the third generation at 15 weeks of age.

No statistically significant differences were noted with spleen weight proportions.

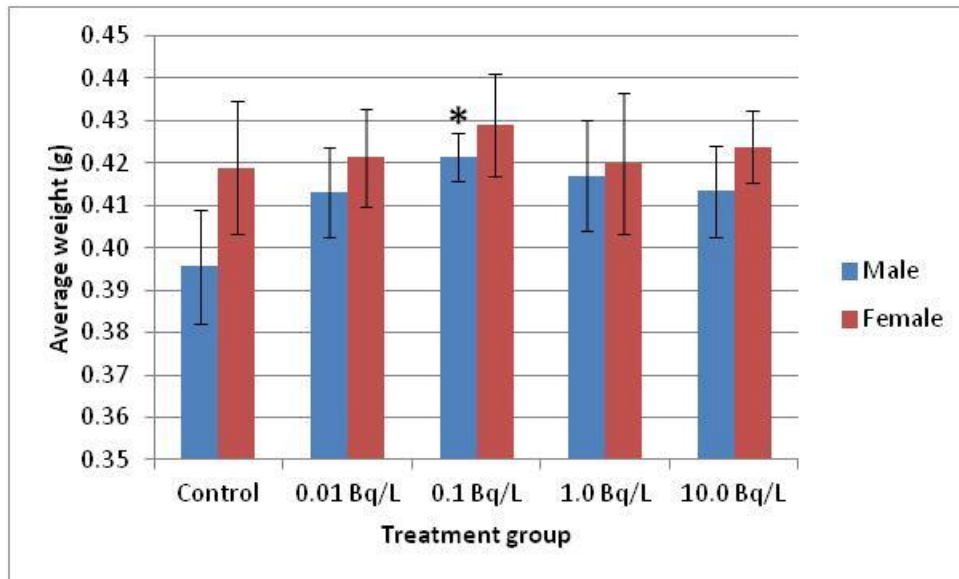


Figure 68: Weights of brain for the third generation at 15 weeks of age. * Indicates statistical difference from control.

When comparing brain weights, the only difference was noted between the control and males in the 0.01 Bq/L group (t-test, $p=0.016$), where the control males had significantly smaller brain weights.

7.5 Comparison of organ weights of fourth generation mice collected at 7 weeks of age

Figures 69 – 74 show the data collected from 5 males and 5 females from each group in the fourth generation euthanized at 7 weeks of age. It is estimated that the males would have consumed about 46 mL of water and the female mice would have consumed about 42 mL of water prior to euthanasia. Refer to Appendix B for the raw data.

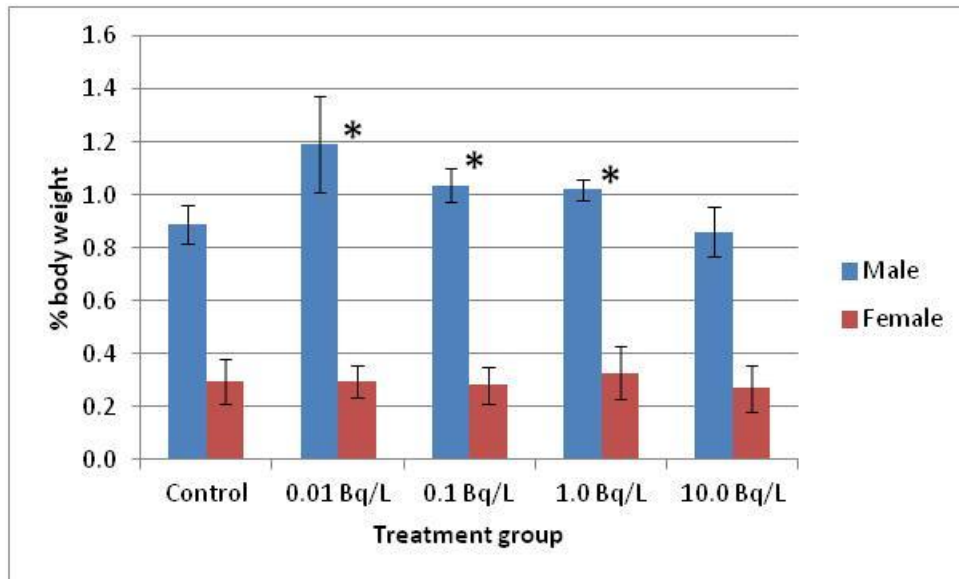


Figure 69: Weights of gonads as proportion of body weight for the fourth generation at 7 weeks of age. * Indicates statistical difference from control.

No differences existed between the females in the treatment groups and the control. However, for the males, mice in the 0.01 Bq/L (t-test, $p=0.044$), 0.1 Bq/L (t-test, $p=0.022$) and 1.0 Bq/L (t-test, $p=0.003$) groups had statistically greater proportions of gonads weight to body weight compared to the control.

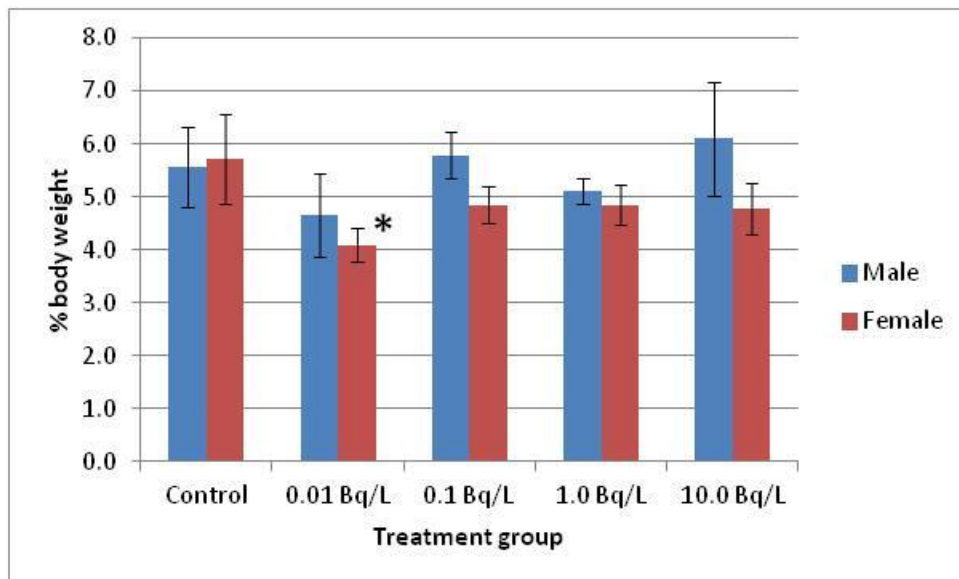


Figure 70: Weights of liver as a proportion of body weight for the fourth generation at 7 weeks of age. * Indicates statistical difference from control.

Females in the 0.01 Bq/L group (t-test, $p=0.016$) had significantly lower proportions of liver weight to body weight when compared to the control group. No other differences existed.

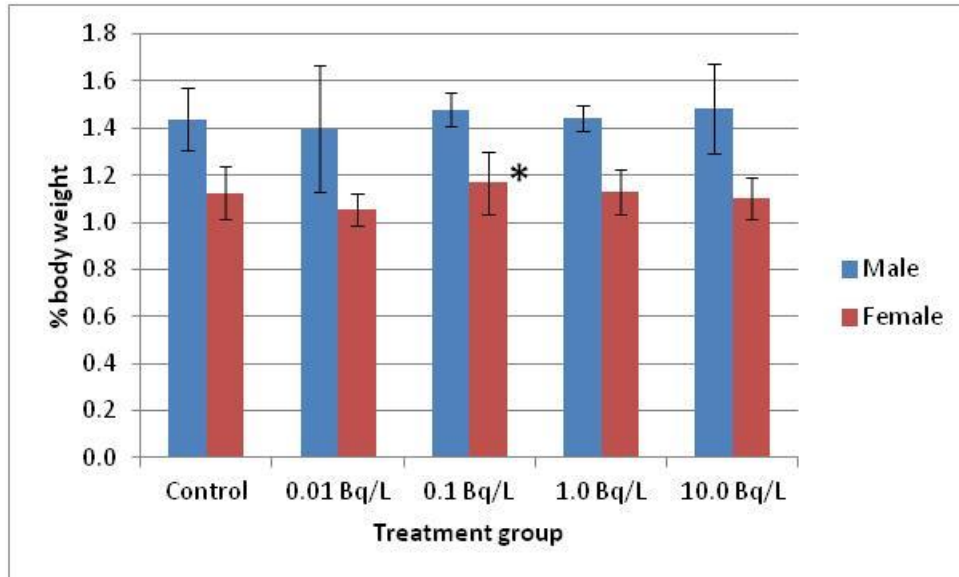


Figure 71: Weights of kidney as proportion of body weight for the fourth generation at 7 weeks of age. * Indicates statistical difference from control.

Females in the 0.1 Bq/L group (t-test, $p=0.043$) showed greater proportions of kidney weight to body weight when compared to the controls. No significant differences existed with the males.

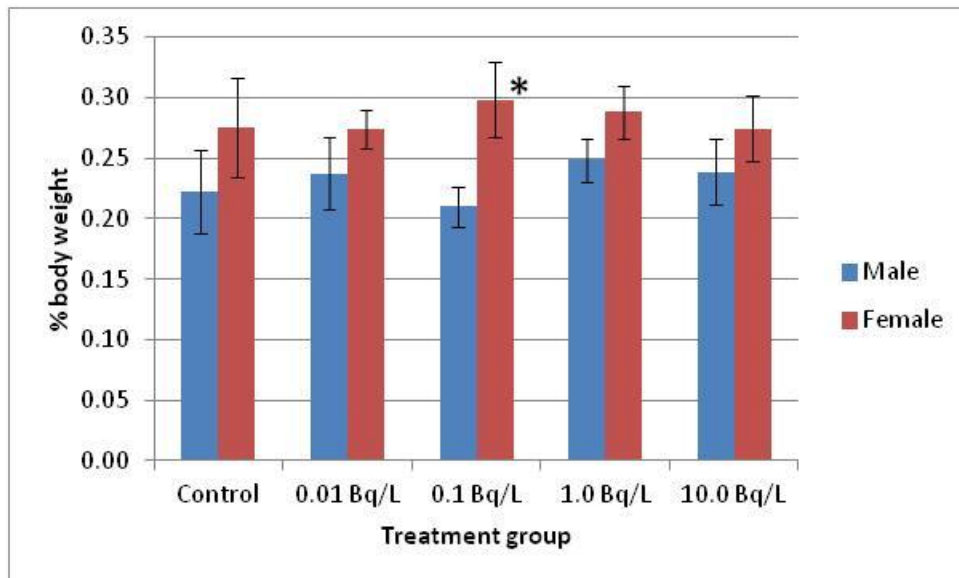


Figure 72: Weights of spleen as a proportion of body weight for the fourth generation at 7 weeks of age. * Indicates statistical difference from control.

Females in the 0.1 Bq/L group (t-test, $p=0.027$) had significantly greater proportions of spleen weight to body weight when compared to controls. No other differences were noted.

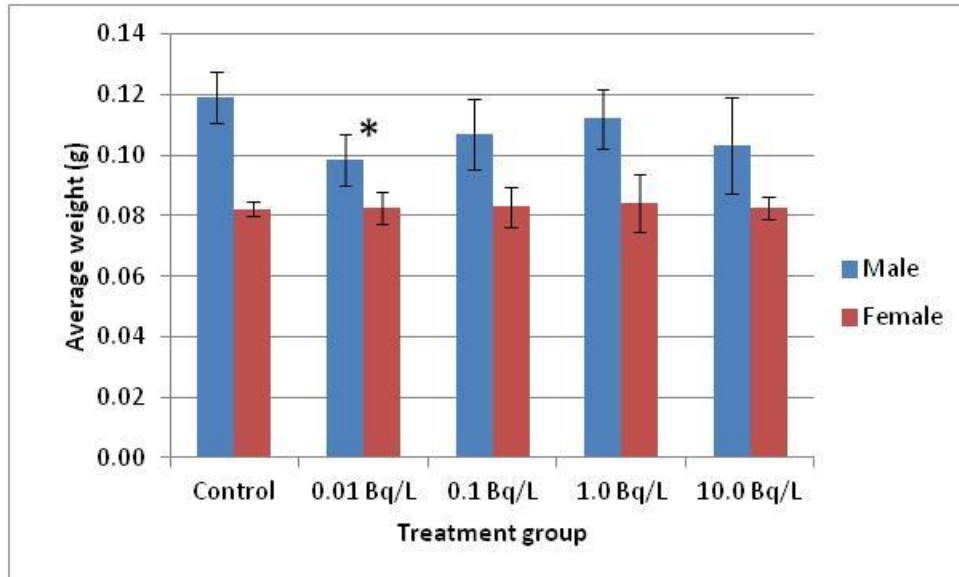


Figure 73: Weights of heart for the fourth generation at 7 weeks of age. * Indicates statistical difference from control.

The only significant difference noted with heart weights was seen when comparing males in the 0.01 Bq/L group (t-test, $p=0.037$) and controls, where the 0.01 Bq/L mice had smaller heart weights.

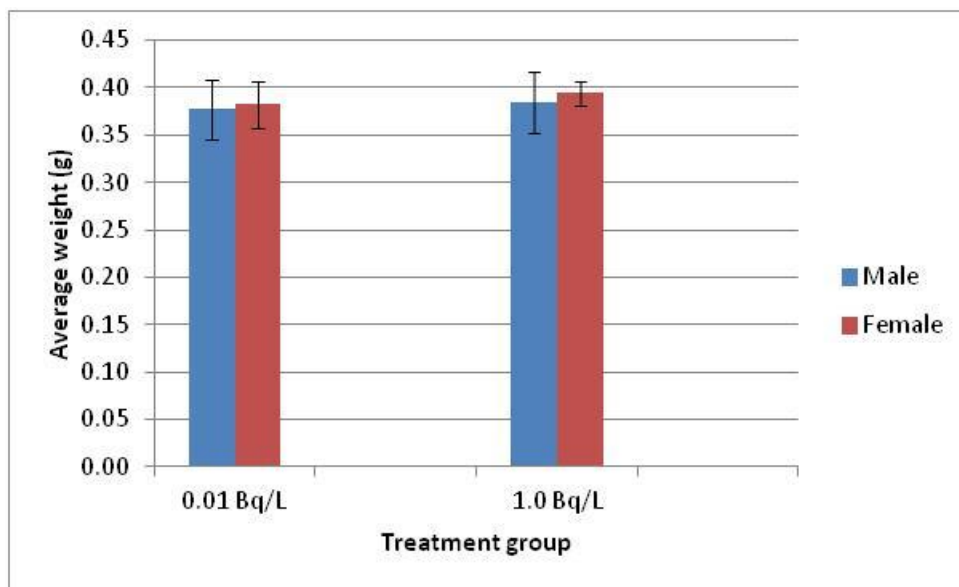


Figure 74: Weights of brain for the fourth generation at 7 weeks of age.

Statistical analysis could not be performed because brain weights were not collected for the control mice in this group.

7.6 Summary of the weight data

Across generations, for the males, no consistent statistically significant differences were noted for liver, kidneys, spleen, heart and brain. It was observed that generation 1 males at 35-37 weeks of age had a tendency to have more fat associated with their gonads in Ra-226 exposed groups compared to controls. Although this was not observed at 6 weeks of age, 7 week old male mice in the 0.01, 0.1 and 1.0 Bq/L groups of the fourth generation also had more fat associated with their gonads. For the females, no consistent statistically significant differences were noted for gonads, liver, kidneys, spleen, heart and brain. Refer to Table 4 and 5 for details.

Table 4:
Male organ weight statistics summary table

	*Gonads	Liver	Kidneys	Spleen	Heart	Brain
5 weeks Gen 3		-1.0 Bq/L				
6 weeks Gen 2		+0.1 Bq/L	+0.01 Bq/L		-0.1 Bq/L -1.0 Bq/L -10.0 Bq/L	
6 weeks Gen 3						
6 weeks Gen 4		-10.0 Bq/L				
7 weeks Gen 2						
7 weeks Gen 4	+0.01 Bq/L +0.1 Bq/L +1.0 Bq/L				-0.01 Bq/L	N/A
15 weeks Gen 3	+1.0 Bq/L				N/A	+0.1 Bq/L
25 weeks Gen 2					N/A	
35-37 weeks Gen 1	+ 0.01 Bq/L + 0.1 Bq/L + 1.0 Bq/L +10.0 Bq/L		+1.0 Bq/L		N/A	+1.0 Bq/L

+ indicates that the value obtained was statistically larger than the corresponding control.

- indicates that the value obtained was statistically smaller than the corresponding control.

N/A indicates that the data have not been collected.

Table 5:
Female organ weight statistics summary table

	*Gonads	Liver	Kidneys	Spleen	Heart	Brain
5 weeks Gen 3				-0.01 Bq/L -1.0 Bq/L		
6 weeks Gen 2						
6 weeks Gen 3		-1.0 Bq/L			-1.0 Bq/L	
6 weeks Gen 4			+10.0 Bq/L	+0.1 Bq/L +10.0 Bq/L	-1.0 Bq/L	
7 weeks Gen 2						
7 weeks Gen 4		-0.01 Bq/L	-0.01 Bq/L	+0.1 Bq/L		N/A
15 weeks Gen 3					N/A	
25 weeks Gen 2			-1.0 Bq/L -10.0 Bq/L		N/A	
35-37 weeks Gen 1		+10.0 Bq/L	-0.01 Bq/L		N/A	

+ indicates that the value obtained was statistically larger than the corresponding control.

- indicates that the value obtained was statistically smaller than the corresponding control.

N/A indicates that the data have not been collected.

8. CONCLUSIONS

This multigenerational mouse study did not reveal any detrimental effects of Ra-226 exposure (up to 8.16 Bq/L) through drinking water on health, growth and reproduction. The first generation of mice was exposed for about 30 weeks (starting at about 7 weeks of age) and was monitored up to 37 weeks of age. The second generation of mice was exposed *in utero* and was observed until the mice were 25 weeks of age. The third generation was of parents that were exposed *in utero* and all of their lives. The third generation of mice was also exposed all of their lives. These mice were kept until they reached the age of 15 weeks and were also monitored daily, as the previous generations. The study was concluded 7 weeks after the fourth generation of mice was obtained. Again, the last generation received Ra-226, through drinking water, throughout their lives.

It was observed in the first generation that there was a tendency for the male gonads to be associated with more fat tissues in the Ra-226 exposed groups compared to the control group. This was the only consistent statistically significant correlation that could be noted with Ra-226 exposure.

Tissues were collected from 5 males and 5 females from each of the treatment groups, at a number of time points, for dosimetric and biological health indicator measurements. The time points were:

- 35-37 weeks of age for the first generation;
- 6-7 and 25 weeks of age for the second generation;
- 5-6 and 15 weeks of age for the third generation; and
- 6-7 weeks of age for the fourth generation.

The samples collected will be analyzed by AECL, McMaster University and other collaborating institutions. The results are expected to be published in the open literature in the years to come.

9. ACKNOWLEDGEMENTS

We would like to acknowledge Ben Su, Meloja Satkunam, and Dr. Harry Peery for performing mice husbandry. We would also like to thank Dr. Heather Wyatt and Mrs. Michelle Bugden at the BRF of AECL for their ongoing support to the project. Yvonne Devantier from AECL's Radiation Protection Unit has also been very helpful. At McMaster University, Dr. Carmel Mothersill, Dr. Colin Seymour, and Dr. Richard Smith have also helped with this study.

Appendix A Experimental Design Flow Chart

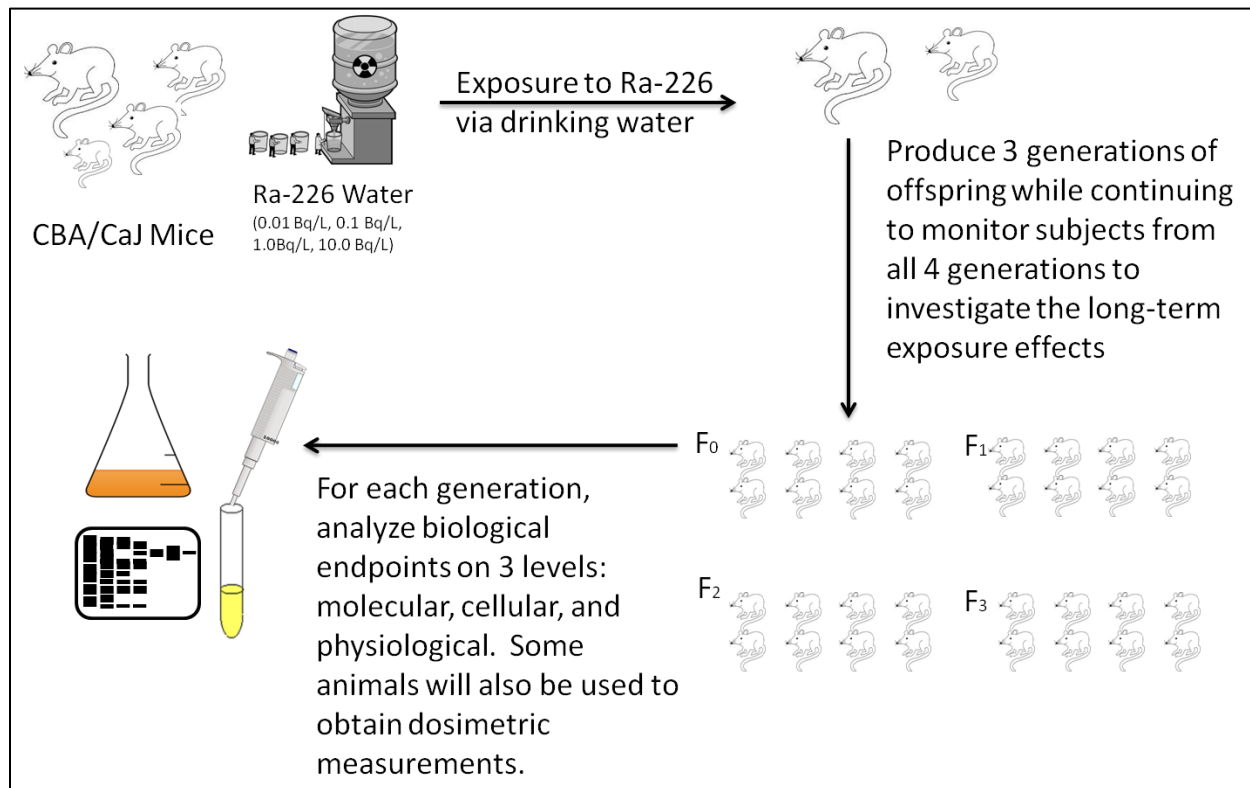


Figure A-1: Experimental design flow chart

Appendix B

Tables of All Organ Weight Measurements from First, Second, Third and Fourth Generation Mice

Table B-1: Raw weight data for the first generation control males. Reps 1-10 were euthanized at 35-37 weeks of age and Reps 11-20 were euthanized at 40-42 weeks of age.

			Body wt	Body Length	Total Length	Control									
						Gonads		Liver		Kidney		Spleen		Brain	
						Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight
Male	35-37 weeks of age	Rep 1	38.2	10.3	19.5	0.3058	0.80	1.6450	4.31	0.5708	1.49	0.0647	0.17	0.4301	1.13
		Rep 2	39.8	10.0	19.3	0.2661	0.67	1.8274	4.59	0.6128	1.54	0.0635	0.16	0.4103	1.03
		Rep 3	38.2	10.3	19.5	0.1989	0.52	1.7859	4.68	0.5713	1.50	0.0672	0.18	0.4170	1.09
		Rep 4	33.6	10.0	19.0	0.2637	0.78	1.2426	3.70	0.5073	1.51	0.0522	0.16	0.3896	1.16
		Rep 5	37.8	10.3	19.3	0.2053	0.54	1.6523	4.37	0.5705	1.51	0.0708	0.19	0.4012	1.06
		Rep 6	38.9	10.0	19.5										
		Rep 7	38.7	10.3	19.5										
		Rep 8	35.2	9.8	18.8										
		Rep 9	35.9	9.8	18.8										
		Rep 10	43.1	10.3	19.5										
	40-42 weeks of age	Rep 11	39.5	10.3	19.8										
		Rep 12	40.3	10.5	20.0										
		Rep 13	38.7	9.8	19.0										
		Rep 14	40.3	10.0	19.5										
		Rep 15	38.0	9.8	19.3										
		Rep 16	35.1	10.0	19.5										
		Rep 17	39.2	10.0	19.5										
		Rep 18	39.2	9.8	18.8										
		Rep 19	38.1	10.0	19.3										
		Rep 20	39.1	10.0	19.3										

Table B-2: Raw weight data for the first generation control females. Reps 1-10 were euthanized at 35-37 weeks of age and Reps 11-20 were euthanized at 40-42 weeks of age.

			Body wt	Body Length	Total Length	Control									
						Gonads		Liver		Kidney		Spleen		Brain	
						Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight
Female	35-37 weeks of age	Rep 1	30.1	10.3	19.5	0.1438	0.48	1.2059	4.01	0.2669	0.89	0.0613	0.20	0.4300	1.43
		Rep 2	33.5	9.8	19.0	0.1247	0.37	1.3150	3.93	0.3237	0.97	0.0789	0.24	0.4208	1.26
		Rep 3	31.5	10.0	18.5	0.0952	0.30	1.1836	3.76	0.3086	0.98	0.0710	0.23	0.4325	1.37
		Rep 4	33.1	10.0	19.0	0.1129	0.34	1.1383	3.44	0.3226	0.97	0.0577	0.17	0.4290	1.30
		Rep 5	25.0	9.5	18.0	0.1055	0.42	0.9009	3.60	0.2427	0.97	0.0585	0.23	0.3754	1.50
		Rep 6	31.0	10.0	19.0										
		Rep 7	36.3	10.5	20.0										
		Rep 8	31.7	10.0	19.0										
		Rep 9	29.3	10.0	18.5										
		Rep 10	30.8	10.0	19.3										
	40-42 weeks of age	Rep 11	34.8	10.0	19.0										
		Rep 12	30.8	10.0	19.0										
		Rep 13	33.8	10.0	19.0										
		Rep 14	28.6	9.8	18.3										
		Rep 15	27.8	9.5	18.5										
		Rep 16	34.8	10.0	19.0										
		Rep 17	32.8	10.0	19.0										
		Rep 18	34.4	10.0	19.0										
		Rep 19	34.8	10.0	18.8										
		Rep 20	37.4	10.3	19.5										

Table B-3: Raw weight data for the first generation 0.01 Bq/L males. Reps 1-10 were euthanized at 35-37 weeks of age and Reps 11-20 were euthanized at 40-42 weeks of age.

0.01 Bq/L															
Male			Body wt	Body Length	Total Length	Gonads		Liver		Kidney		Spleen		Brain	
						Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight
	35-37 weeks of age	Rep 1	37.8	10.0	19.3	0.3643	0.96	1.7236	4.56	0.5890	1.56	0.0635	0.17	0.4234	1.12
		Rep 2	38.5	10.0	19.3	0.4482	1.16	1.4878	3.86	0.5904	1.53	0.0673	0.17	0.4368	1.13
		Rep 3	41.0	10.5	19.5	0.4199	1.02	1.9508	4.76	0.6483	1.58	0.0713	0.17	0.4338	1.06
		Rep 4	36.1	10.0	19.0	0.3687	1.02	1.3557	3.76	0.6151	1.70	0.0591	0.16	0.4179	1.16
		Rep 5	40.8	10.3	19.5	0.4219	1.03	1.9344	4.74	0.6255	1.53	0.0740	0.18	0.4288	1.05
		Rep 6	38.9	10.0	19.0										
		Rep 7	36.4	10.3	19.0										
		Rep 8	39.9	10.0	19.0										
		Rep 9	34.9	9.8	18.5										
		Rep 10	40.6	10.3	19.8										
	40-42 weeks of age	Rep 11	37.8	10.0	19.5										
		Rep 12	37.2	9.5	18.5										
		Rep 13	39.1	10.3	19.3										
		Rep 14	40.5	10.3	19.3										
		Rep 15	38.8	10.0	19.3										
		Rep 16	38.6	10.0	19.0										
		Rep 17	33.8	10.0	19.3										
		Rep 18	36.3	10.0	19.3										
		Rep 19	41.1	10.3	19.8										
		Rep 20	35.8	9.8	18.8										

Table B-4: Raw weight data for the first generation 0.01 Bq/L females. Reps 1-10 were euthanized at 35-37 weeks of age and Reps 11-20 were euthanized at 40-42 weeks of age.

0.01 Bq/L															
			Body wt	Body Length	Total Length	Gonads		Liver		Kidney		Spleen		Brain	
						Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight
Female	35-37 weeks of age	Rep 1	37.9	10.5	19.5	0.2343	0.62	1.4790	3.90	0.3138	0.83	0.0687	0.18	0.4433	1.17
		Rep 2	31.5	10.0	18.8	0.0940	0.30	1.3116	4.16	0.2873	0.91	0.0635	0.20	0.4546	1.44
		Rep 3	29.8	9.5	18.5	0.1112	0.37	1.2265	4.12	0.2801	0.94	0.0718	0.24	0.4204	1.41
		Rep 4	30.7	10.0	19.0	0.0963	0.31	1.1561	3.77	0.2973	0.97	0.0671	0.22	0.4189	1.36
		Rep 5	38.1	10.5	19.0	0.1185	0.31	1.4004	3.68	0.3587	0.94	0.0731	0.19	0.4009	1.05
		Rep 6	31.1	10.0	18.5										
		Rep 7	29.5	10.0	18.5										
		Rep 8	31.2	9.5	18.3										
		Rep 9	32.6	10.0	19.0										
		Rep 10	34.7	10.3	19.3										
	40-42 weeks of age	Rep 11	36.6	10.0	19.3										
		Rep 12	33.0	10.3	19.5										
		Rep 13	29.9	9.8	19.0										
		Rep 14	31.9	9.8	18.5										
		Rep 15	35.7	10.0	19.3										
		Rep 16	33.8	10.0	19.3										
		Rep 17	25.2	9.8	19.3										
		Rep 18	35.2	10.3	19.5										

Table B-5: Raw weight data for the first generation 0.1 Bq/L males. Reps 1-10 were euthanized at 35-37 weeks of age and Reps 11-20 were euthanized at 40-42 weeks of age.

0.1 Bq/L															
			Body wt	Body Length	Total Length	Gonads		Liver		Kidney		Spleen		Brain	
						Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight
Male	35-37 weeks of age	Rep 1	38.2	10.0	19.5	0.4069	1.07	1.5740	4.12	0.5770	1.51	0.0639	0.17	0.4233	1.11
		Rep 2	41.5	10.5	20.0	0.3542	0.85	2.1217	5.11	0.6532	1.57	0.0670	0.16	0.4137	1.00
		Rep 3	37.4	10.3	19.5	0.4230	1.13	1.7650	4.72	0.5847	1.56	0.0709	0.19	0.4223	1.13
		Rep 4	36.5	10.0	19.3	0.4368	1.20	1.5704	4.30	0.6230	1.71	0.0673	0.18	0.4204	1.15
		Rep 5	38.1	10.0	19.0	0.4767	1.25	1.6709	4.39	0.5913	1.55	0.0635	0.17	0.3902	1.02
		Rep 6	40.7	10.3	19.3										
		Rep 7	42.9	10.5	20.0										
		Rep 8	37.5	10.0	19.3										
		Rep 9	39.9	10.5	19.5										
		Rep 10	40.4	10.5	19.3										
	40-42 weeks of age	Rep 11	39.7	10.0	19.5										
		Rep 12	35.4	10.0	19.0										
		Rep 13	29.1	9.5	18.3										
		Rep 14	36.9	10.0	19.0										
		Rep 15	38.4	10.0	19.0										
		Rep 16	40.1	10.0	19.8										
		Rep 17	41.1	10.3	19.8										
		Rep 18	35.4	9.8	19.3										
		Rep 19	36.1	10.0	19.5										
		Rep 20	38.5	N/A	N/A										

Table B-6: Raw weight data for the first generation 0.1 Bq/L females. Reps 1-10 were euthanized at 35-37 weeks of age and Reps 11-20 were euthanized at 40-42 weeks of age.

0.1 Bq/L															
			Body wt	Body Length	Total Length	Gonads		Liver		Kidney		Spleen		Brain	
						Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight
Female	35-37 weeks of age	Rep 1	27.8	10.3	19.5	0.0787	0.28	1.0682	3.84	0.2645	0.95	0.0626	0.23	0.4400	1.58
		Rep 2	29.4	9.8	18.8	0.1182	0.40	1.1254	3.83	0.2852	0.97	0.0671	0.23	0.4288	1.46
		Rep 3	29.1	10.0	18.5	0.1085	0.37	1.1618	3.99	0.2797	0.96	0.0742	0.25	0.4149	1.43
		Rep 4	31.0	10.0	19.5	0.0807	0.26	1.1469	3.70	0.3268	1.05	0.0693	0.22	0.3730	1.20
		Rep 5	34.8	9.8	18.8	0.1127	0.32	1.2038	3.46	0.3360	0.97	0.0684	0.20	0.4113	1.18
		Rep 6	27.4	10.0	19.5										
		Rep 7	34.1	10.3	19.3										
		Rep 8	30.4	10.3	19.8										
		Rep 9	28.2	10.3	19.0										
		Rep 10	34.4	10.5	20.0										
	40-42 weeks of age	Rep 11	32.9	10.3	19.8										
		Rep 12	35.2	10.3	19.8										
		Rep 13	33.6	10.3	19.5										
		Rep 14	33.3	10.0	19.3										
		Rep 15	28.5	9.8	19.0										
		Rep 16	35.5	10.0	19.5										
		Rep 17	31.9	10.0	19.3										
		Rep 18	29.3	9.8	19.0										
		Rep 19	32.4	10.0	19.0										
		Rep 20	26.0	9.8	19.0										

Table B-7: Raw weight data for the first generation 1.0 Bq/L males. Reps 1-10 were euthanized at 35-37 weeks of age and Reps 11-20 were euthanized at 40-42 weeks of age.

1.0 Bq/L															
			Body wt	Body Length	Total Length	Gonads		Liver		Kidney		Spleen		Brain	
						Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight
Male	35-37 weeks of age	Rep 1	36.6	10.3	19.5	0.3689	1.01	1.6514	4.51	0.5724	1.56	0.0597	0.16	0.4395	1.20
		Rep 2	38.4	10.0	19.8	0.3987	1.04	1.5212	3.96	0.6471	1.69	0.0648	0.17	0.4373	1.14
		Rep 3	38.1	10.0	18.5	0.3772	0.99	1.6893	4.43	0.6203	1.63	0.0673	0.18	0.4231	1.11
		Rep 4	38.6	10.5	19.5	0.3920	1.02	1.8082	4.68	0.6271	1.62	0.0713	0.18	0.4039	1.05
		Rep 5	35.5	10.0	19.3	0.3984	1.12	1.3939	3.93	0.5673	1.60	0.0647	0.18	0.4161	1.17
		Rep 6	36.9	10.0	18.5										
		Rep 7	38.5	10.0	18.5										
		Rep 8	38.1	10.3	19.3										
		Rep 9	36.2	10.3	19.0										
		Rep 10	40.1	10.3	20.0										
	40-42 weeks of age	Rep 11	36.6	9.8	19.3										
		Rep 12	40.1	10.0	19.8										
		Rep 13	35.8	10.0	19.3										
		Rep 14	39.8	10.5	20.0										
		Rep 15	38.5	10.5	20.0										
		Rep 16	39.9	10.5	20.5										
		Rep 17	35.4	10.0	19.3										
		Rep 18	35.3	10.0	19.5										
		Rep 19	40.3	10.5	20.0										

Table B-8: Raw weight data for the first generation 1.0 Bq/L females. Reps 1-10 were euthanized at 35-37 weeks of age and Reps 11-20 were euthanized at 40-42 weeks of age.

1.0 Bq/L															
			Body wt	Body Length	Total Length	Gonads		Liver		Kidney		Spleen		Brain	
						Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight
Female	35-37 weeks of age	Rep 1	34.0	10.0	19.5	0.1668	0.49	1.2949	3.81	0.3068	0.90	0.0690	0.20	0.4363	1.28
		Rep 2	29.2	9.8	19.0	0.0910	0.31	1.0936	3.75	0.2731	0.94	0.0621	0.21	0.4504	1.54
		Rep 3	31.8	10.3	19.0	0.1240	0.39	1.2365	3.89	0.3048	0.96	0.0655	0.21	0.4265	1.34
		Rep 4	36.0	10.0	19.3	0.1393	0.39	1.2494	3.47	0.3133	0.87	0.0766	0.21	0.4308	1.20
		Rep 5	37.5	10.5	19.3	0.1179	0.31	1.3955	3.72	0.3624	0.97	0.0760	0.20	0.4092	1.09
		Rep 6	36.4	10.5	19.5										
		Rep 7	34.6	10.0	19.3										
		Rep 8	33.2	10.0	19.3										
		Rep 9	33.0	10.3	19.0										
		Rep 10	31.4	10.0	19.0										
	40-42 weeks of age	Rep 11	31.6	10.0	19.5										
		Rep 12	27.6	10.0	18.8										
		Rep 13	34.9	10.3	19.8										
		Rep 14	31.0	10.0	19.3										
		Rep 15	28.9	10.3	19.3										
		Rep 16	31.8	10.3	19.3										
		Rep 17	33.0	10.0	19.3										
		Rep 18	29.6	10.0	19.3										
		Rep 19	29.4	10.0	19.3										
		Rep 20	28.2	9.8	18.8										

Table B-9: Raw weight data for the first generation 10.0 Bq/L males. Reps 1-10 were euthanized at 35-37 weeks of age and Reps 11-20 were euthanized at 40-42 weeks of age.

10.0 Bq/L															
			Body wt	Body Length	Total Length	Gonads		Liver		Kidney		Spleen		Brain	
						Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight
Male	35-37 weeks of age	Rep 1	38.8	10.0	19.5	0.4134	1.07	1.7723	4.57	0.6068	1.56	0.0745	0.19	0.4230	1.09
		Rep 2	37.7	10.0	19.8	0.4304	1.14	1.5855	4.21	0.6177	1.64	0.0697	0.18	0.4547	1.21
		Rep 3	40.3	10.3	19.5	0.3534	0.88	1.9683	4.88	0.6208	1.54	0.0692	0.17	0.4301	1.07
		Rep 4	36.1	10.0	18.8	0.4008	1.11	1.5053	4.17	0.5073	1.41	0.0694	0.19	0.3939	1.09
		Rep 5	31.8	9.5	19.0	0.3192	1.00	1.2028	3.78	0.5420	1.70	0.0503	0.16	0.3910	1.23
		Rep 6	36.6	10.3	19.5										
		Rep 7	38.2	10.3	19.0										
		Rep 8	38.0	10.5	19.8										
		Rep 9	39.8	10.5	19.8										
		Rep 10	37.9	10.0	19.3										
	40-42 weeks of age	Rep 11	40.2	9.5	19.0										
		Rep 12	37.7	10.0	19.0										
		Rep 13	41.3	9.8	19.8										
		Rep 14	37.8	10.0	19.5										
		Rep 15	41.5	10.0	19.5										
		Rep 16	36.0	10.0	19.5										
		Rep 17	37.1	10.0	20.0										
		Rep 18	40.4	10.3	19.8										
		Rep 19	38.4	10.3	19.8										
		Rep 20	37.5	10.5	20.0										

Table B-10: Raw weight data for the first generation 10.0 Bq/L females. Reps 1-10 were euthanized at 35-37 weeks of age and Reps 11-20 were euthanized at 40-42 weeks of age.

10.0 Bq/L															
			Body wt	Body Length	Total Length	Gonads		Liver		Kidney		Spleen		Brain	
						Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight
Female	35-37 weeks of age	Rep 1	30.4	9.8	18.8	0.0819	0.27	1.2595	4.14	0.2755	0.91	0.0647	0.21	0.4271	1.40
		Rep 2	31.1	10.0	19.5	0.1012	0.33	1.2961	4.17	0.3124	1.00	0.0616	0.20	N/A	N/A
		Rep 3	33.4	10.3	19.3	0.1129	0.34	1.3689	4.10	0.3112	0.93	0.0749	0.22	0.4385	1.31
		Rep 4	32.5	10.0	19.0	0.1502	0.46	1.3478	4.15	0.2967	0.91	0.0651	0.20	0.3975	1.22
		Rep 5	31.6	9.8	18.8	0.1247	0.39	1.4694	4.65	0.3597	1.14	0.1400	0.44	0.4025	1.27
		Rep 6	29.4	10.0	19.0										
		Rep 7	33.2	10.3	19.5										
		Rep 8	27.3	9.8	18.8										
		Rep 9	33.7	10.0	18.8										
		Rep 10	30.4	10.0	19.3										
	40-42 weeks of age	Rep 11	28.6	10.0	19.5										
		Rep 12	27.7	9.8	18.8										
		Rep 13	30.0	10.0	19.5										
		Rep 14	25.6	9.8	18.5										
		Rep 15	31.0	10.0	19.0										
		Rep 16	36.0	10.5	20.0										
		Rep 17	30.6	10.0	19.0										
		Rep 18	31.7	9.8	18.8										
		Rep 19	27.2	10.0	19.0										
		Rep 20	25.8	9.5	18.0										

Table B-11: Raw weight data for the second generation control males. Reps 1-10 were euthanized at 25 weeks of age and Reps 11-20 were euthanized at 29 weeks of age.

		Control													
			Body wt	Body Length	Total Length	Gonads		Liver		Kidney		Spleen		Brain	
						Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight
Male	25 weeks of age	Rep 1	40.2	10.0	19.3	0.3694	0.92	1.9123	4.76	0.6065	1.51	0.0698	0.17	0.4286	1.07
		Rep 2	37.5	10.3	19.8	0.4346	1.16	1.7323	4.62	0.5785	1.54	0.0581	0.15	0.4217	1.12
		Rep 3	41.9	10.3	19.8	0.3749	0.89	2.1923	5.23	0.6498	1.55	0.0844	0.20	0.4513	1.08
		Rep 4	40.0	10.3	19.5	0.4232	1.06	1.8173	4.54	0.6830	1.71	0.0751	0.19	0.4138	1.03
		Rep 5	39.4	10.3	19.5	0.4446	1.13	1.5502	3.93	0.6192	1.57	0.0749	0.19	0.4199	1.07
		Rep 6	35.3	10.0	19.5										
		Rep 7	40.9	10.0	19.3										
		Rep 8	39.0	10.0	19.5										
		Rep 9	41.0	10.0	19.0										
		Rep 10	38.5	10.0	19.3										
	29 weeks of age	Rep 11	39.3	10.3	19.5										
		Rep 12	42.2	10.0	19.0										
		Rep 13	40.3	10.0	19.8										
		Rep 14	34.9	10.0	19.5										
		Rep 15	38.0	10.0	19.5										
		Rep 16	36.5	10.0	19.3										
		Rep 17	39.3	10.5	20.0										
		Rep 18	40.3	10.5	20.0										
		Rep 19	38.4	10.5	20.0										
		Rep 20	37.7	10.5	20.0										

Table B-12: Raw weight data for the second generation control females. Reps 1-10 were euthanized at 25 weeks of age and Reps 11-20 were euthanized at 29 weeks of age.

Control															
			Body wt	Body Length	Total Length	Gonads		Liver		Kidney		Spleen		Brain	
						Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight
Female	25 weeks of age	Rep 1	31.4	10.3	19.5	0.0889	0.28	1.1624	3.70	0.3173	1.01	0.0684	0.22	0.4391	1.40
		Rep 2	33.1	10.5	19.8	0.1493	0.45	1.3856	4.19	0.3419	1.03	0.0788	0.24	0.4409	1.33
		Rep 3	31.5	10.5	19.5	0.1344	0.43	1.2826	4.07	0.3177	1.01	0.0755	0.24	0.4244	1.35
		Rep 4	27.1	9.5	18.5	0.0986	0.36	1.0600	3.91	0.2971	1.10	0.0840	0.31	0.3595	1.33
		Rep 5	30.8	10.0	19.0	0.1503	0.49	1.1846	3.85	0.2974	0.97	0.0707	0.23	0.4299	1.40
		Rep 6	31.2	10.0	19.0										
		Rep 7	35.4	10.3	19.5										
		Rep 8	31.8	10.0	19.5										
		Rep 9	33.2	10.0	19.5										
		Rep 10	32.5	10.3	19.5										
	29 weeks of age	Rep 11	37.2	10.3	19.3										
		Rep 12	33.4	10.3	19.5										
		Rep 13	35.1	9.5	18.0										
		Rep 14	34.0	10.5	20.0										
		Rep 15	33.9	10.3	19.3										
		Rep 16	35.5	10.5	19.8										
		Rep 17	33.1	10.3	19.8										
		Rep 18	33.1	10.0	19.5										
		Rep 19	33.7	10.3	19.3										
		Rep 20	33.5	10.0	19.0										

Table B-13: Raw weight data for the second generation 0.01 Bq/L males. Reps 1-10 were euthanized at 25 weeks of age and Reps 11-20 were euthanized at 29 weeks of age.

0.01 Bq/L															
			Body wt	Body Length	Total Length	Gonads		Liver		Kidney		Spleen		Brain	
						Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight
Male	25 weeks of age	Rep 1	32.4	9.8	18.5	0.3154	0.97	1.2955	4.00	0.4709	1.45	0.0522	0.16	0.4107	1.27
		Rep 2	39.5	10.0	19.3	0.3963	1.00	1.8488	4.68	0.6501	1.65	0.0672	0.17	0.4446	1.13
		Rep 3	37.1	10.0	19.0	0.4053	1.09	1.8135	4.89	0.5831	1.57	0.0671	0.18	0.4355	1.17
		Rep 4	39.5	10.0	19.0	0.4679	1.18	1.6220	4.11	0.6625	1.68	0.0750	0.19	0.4017	1.02
		Rep 5	28.1	9.5	17.8	0.3360	1.20	1.1273	4.01	0.3751	1.33	0.0473	0.17	0.3573	1.27
		Rep 6	38.6	10.0	19.3										
		Rep 7	31.1	9.8	18.5										
		Rep 8	36.4	10.0	19.0										
		Rep 9	30.5	9.5	18.5										
		Rep 10	38.8	10.3	19.8										
	29 weeks of age	Rep 11	39.5	10.3	19.5										
		Rep 12	35.8	10.3	19.5										
		Rep 13	43.0	10.5	19.8										
		Rep 14	35.7	10.0	19.5										
		Rep 15	39.6	10.3	19.5										
		Rep 16	36.7	9.8	19.0										
		Rep 17	38.4	10.3	19.8										
		Rep 18	29.1	9.5	18.8										
		Rep 19	37.3	10.0	19.5										
		Rep 20	33.7	9.8	19.0										

Table B-14: Raw weight data for the second generation 0.01 Bq/L females. Reps 1-10 were euthanized at 25 weeks of age and Reps 11-20 were euthanized at 29 weeks of age.

0.01 Bq/L															
			Body wt	Body Length	Total Length	Gonads		Liver		Kidney		Spleen		Brain	
						Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight
Female	25 weeks of age	Rep 1	31.5	9.5	18.5	0.1027	0.33	1.2220	3.88	0.3055	0.97	0.0662	0.21	0.4336	1.38
		Rep 2	27.7	9.5	17.8	0.1199	0.43	0.9284	3.35	0.2481	0.90	0.0569	0.21	0.4127	1.49
		Rep 3	32.6	10.3	19.5	0.1079	0.33	1.2456	3.82	0.3328	1.02	0.0782	0.24	0.4432	1.36
		Rep 4	34.2	10.3	19.5	0.1350	0.39	1.3405	3.92	0.3345	0.98	0.0691	0.20	0.4047	1.18
		Rep 5	33.1	10.0	19.3	0.1264	0.38	1.1724	3.54	0.2924	0.88	0.0654	0.20	0.4199	1.27
		Rep 6	31.4	10.0	19.3										
		Rep 7	32.9	10.0	19.3										
		Rep 8	34.7	10.0	19.3										
		Rep 9	33.1	10.0	19.5										
		Rep 10	33.5	10.3	19.3										
	29 weeks of age	Rep 11	30.7	10.0	19.3										
		Rep 12	32.1	10.3	19.5										
		Rep 13	33.5	10.3	19.8										
		Rep 14	23.2	9.3	18.3										
		Rep 15	30.0	10.0	19.3										
		Rep 16	32.6	10.3	19.5										
		Rep 17	31.1	10.0	19.5										
		Rep 18	30.3	10.0	19.5										
		Rep 19	33.8	10.0	19.3										
		Rep 20	35.0	10.3	19.5										

Table B-15: Raw weight data for the second generation 0.1 Bq/L males. Reps 1-10 were euthanized at 25 weeks of age and Reps 11-20 were euthanized at 29 weeks of age.

0.1 Bq/L															
			Body wt	Body Length	Total Length	Gonads		Liver		Kidney		Spleen		Brain	
						Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight
Male	25 weeks of age	Rep 1	37.2	10.0	19.3	0.4109	1.10	1.6025	4.31	0.6067	1.63	0.0626	0.17	0.4372	1.18
		Rep 2	41.6	10.5	19.8	0.4592	1.10	2.1952	5.28	0.6400	1.54	0.0754	0.18	0.4350	1.05
		Rep 3	38.2	10.3	19.5	0.4035	1.06	1.5788	4.13	0.5586	1.46	0.0609	0.16	0.4307	1.13
		Rep 4	41.7	10.5	19.0	0.4344	1.04	2.0081	4.82	0.6718	1.61	0.0718	0.17	0.4252	1.02
		Rep 5	39.1	10.5	19.8	0.3628	0.93	1.6430	4.20	0.6177	1.58	0.0637	0.16	0.4153	1.06
		Rep 6	37.9	10.0	19.5										
		Rep 7	37.9	9.5	19.3										
		Rep 8	38.5	10.0	19.5										
		Rep 9	38.5	10.0	19.5										
		Rep 10	39.9	10.5	19.5										
	29 weeks of age	Rep 11	43.4	10.3	19.8										
		Rep 12	39.3	9.8	19.3										
		Rep 13	39.7	10.0	19.5										
		Rep 14	41.0	9.8	19.5										
		Rep 15	38.0	10.0	19.8										
		Rep 16	41.5	10.3	19.8										
		Rep 17	40.6	10.3	19.8										
		Rep 18	39.5	10.0	19.5										
		Rep 19	38.3	10.0	19.5										
		Rep 20	39.0	10.0	19.5										

Table B-16: Raw weight data for the second generation 0.1Bq/L females. Reps 1-10 were euthanized at 25 weeks of age and Reps 11-20 were euthanized at 29 weeks of age.

0.1 Bq/L															
			Body wt	Body Length	Total Length	Gonads		Liver		Kidney		Spleen		Brain	
						Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight
Female	25 weeks of age	Rep 1	28.9	9.8	18.5	0.1152	0.40	1.1854	4.10	0.2917	1.01	0.0622	0.22	0.4091	1.42
		Rep 2	34.6	10.3	19.5	0.1445	0.42	1.4135	4.09	0.3391	0.98	0.0833	0.24	0.4380	1.27
		Rep 3	31.5	10.0	19.3	0.1531	0.49	1.1960	3.80	0.3021	0.96	0.0737	0.23	0.4467	1.42
		Rep 4	33.1	10.3	19.5	0.1435	0.43	1.3484	4.07	0.3324	1.00	0.0866	0.26	0.4391	1.33
		Rep 5	32.5	10.0	19.0	0.1098	0.34	1.3715	4.22	0.3112	0.96	0.0741	0.23	0.4307	1.33
		Rep 6	34.9	10.3	19.5										
		Rep 7	32.6	10.0	19.5										
		Rep 8	35.7	10.3	19.8										
		Rep 9	31.9	10.0	19.0										
		Rep 10	32.2	10.0	19.5										
	29 weeks of age	Rep 11	33.3	10.0	19.8										
		Rep 12	29.7	10.3	20.0										
		Rep 13	24.2	9.5	18.5										
		Rep 14	33.2	10.0	19.5										
		Rep 15	34.8	10.0	19.5										
		Rep 16	37.4	10.3	20.0										
		Rep 17	33.4	10.0	19.3										
		Rep 18	33.8	10.3	19.5										
		Rep 19	33.2	10.3	19.5										

Table B-17: Raw weight data for the second generation 1.0 Bq/L males. Reps 1-10 were euthanized at 25 weeks of age and Reps 11-20 were euthanized at 29 weeks of age.

1.0 Bq/L															
			Body wt	Body Length	Total Length	Gonads		Liver		Kidney		Spleen		Brain	
						Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight
Male	25 weeks of age	Rep 1	34.3	9.8	19.3	0.3851	1.12	1.6953	4.94	0.5421	1.58	0.0588	0.17	0.4206	1.23
		Rep 2	38.7	10.3	19.5	0.3212	0.83	1.8885	4.88	0.6094	1.57	0.0778	0.20	0.4320	1.12
		Rep 3	38.1	10.3	19.8	0.4071	1.07	1.6715	4.39	0.5483	1.44	0.0682	0.18	0.4397	1.15
		Rep 4	38.4	10.5	19.8	0.4820	1.26	1.8324	4.77	0.6519	1.70	0.0678	0.18	0.4127	1.07
		Rep 5	37.5	10.5	19.5	0.4447	1.19	1.6813	4.48	0.4978	1.33	0.0622	0.17	0.4177	1.11
		Rep 6	40.3	10.3	20.0										
		Rep 7	38.5	10.3	19.5										
		Rep 8	39.2	10.3	19.8										
		Rep 9	37.8	10.0	19.5										
		Rep 10	33.2	9.5	18.5										
	29 weeks of age	Rep 11	39.0	10.0	19.5										
		Rep 12	36.4	9.8	19.0										
		Rep 13	36.7	10.5	19.8										
		Rep 14	39.4	9.8	19.3										
		Rep 15	38.6	9.8	19.3										
		Rep 16	37.1	10.3	19.5										
		Rep 17	34.2	9.8	18.8										
		Rep 18	37.8	10.0	19.5										
		Rep 19	35.7	10.0	19.5										
		Rep 20	39.4	10.0	19.5										

Table B-18: Raw weight data for the second generation 1.0 Bq/L females. Reps 1-10 were euthanized at 25 weeks of age and Reps 11-20 were euthanized at 29 weeks of age.

1.0 Bq/L															
			Body wt	Body Length	Total Length	Gonads		Liver		Kidney		Spleen		Brain	
						Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight
Female	25 weeks of age	Rep 1	29.3	9.8	19.3	0.1004	0.34	1.2128	4.14	0.2964	1.01	0.0716	0.24	0.4365	1.49
		Rep 2	28.0	9.8	18.8	0.1192	0.43	1.0961	3.91	0.2686	0.96	0.0747	0.27	0.4390	1.57
		Rep 3	31.9	10.0	19.5	0.1175	0.37	1.3407	4.20	0.3074	0.96	0.0787	0.25	0.4317	1.35
		Rep 4	32.0	10.0	19.0	0.0954	0.30	1.3609	4.25	0.3142	0.98	0.0688	0.22	0.3928	1.23
		Rep 5	32.3	10.3	19.5	0.1105	0.34	1.3154	4.07	0.2821	0.87	0.0751	0.23	0.4192	1.30
		Rep 6	31.8	10.0	19.5										
		Rep 7	32.2	10.0	19.5										
		Rep 8	30.2	9.8	19.0										
		Rep 9	35.2	10.0	19.3										
		Rep 10	32.1	9.8	18.8										
	29 weeks of age	Rep 11	34.4	10.0	19.5										
		Rep 12	31.7	10.0	19.3										
		Rep 13	34.7	10.5	20.0										
		Rep 14	35.3	10.3	19.8										
		Rep 15	30.9	10.0	19.5										
		Rep 16	27.1	9.5	18.3										
		Rep 17	33.8	10.3	19.5										
		Rep 18	34.4	10.0	19.8										
		Rep 19	32.4	10.0	19.5										
		Rep 20	31.4	10.3	19.5										

Table B-19: Raw weight data for the second generation 10.0 Bq/L males. Reps 1-10 were euthanized at 25 weeks of age and Reps 11-20 were euthanized at 29 weeks of age.

10.0 Bq/L															
			Body wt	Body Length	Total Length	Gonads		Liver		Kidney		Spleen		Brain	
						Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight
Male	25 weeks of age	Rep 1	37.7	10.0	19.0	0.4134	1.10	1.5843	4.20	0.5425	1.44	0.0613	0.16	0.4330	1.15
		Rep 2	30.8	9.8	19.3	0.3285	1.07	1.1883	3.86	0.4652	1.51	0.0538	0.17	0.4382	1.42
		Rep 3	34.5	9.8	18.8	0.3213	0.93	1.5885	4.60	0.5427	1.57	0.0617	0.18	0.4241	1.23
		Rep 4	36.1	10.0	19.0	0.4375	1.21	1.4061	3.90	0.5720	1.58	0.0565	0.16	0.4160	1.15
		Rep 5	38.0	10.0	19.0	0.4350	1.14	1.7059	4.49	0.5786	1.52	0.0609	0.16	0.4262	1.12
		Rep 6	37.3	10.0	19.3										
		Rep 7	30.5	9.5	18.0										
		Rep 8	35.4	10.0	19.3										
		Rep 9	37.1	10.0	19.0										
		Rep 10	35.6	10.0	19.5										
	29 weeks of age	Rep 11	36.7	10.0	19.0										
		Rep 12	39.3	10.0	19.0										
		Rep 13	39.3	10.0	19.5										
		Rep 14	39.5	9.8	19.3										
		Rep 15	38.8	10.5	20.0										
		Rep 16	33.7	9.5	18.8										
		Rep 17	38.1	10.3	20.0										
		Rep 18	36.8	10.3	20.0										
		Rep 19	34.6	10.0	19.5										

Table B-20: Raw weight data for the second generation 10.0 Bq/L females. Reps 1-10 were euthanized at 25 weeks of age and Reps 11-20 were euthanized at 29 weeks of age.

10.0 Bq/L																
Female	25 weeks of age		Body wt	Body Length	Total Length	Gonads		Liver		Kidney		Spleen		Brain		
						Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight	
		Rep 1	32.2	10.0	19.5	0.1145	0.36	1.2127	3.77	0.3167	0.98	0.0770	0.24	0.4368	1.36	
		Rep 2	30.4	10.0	19.3	0.1295	0.43	1.0841	3.57	0.2746	0.90	0.0682	0.22	0.4227	1.39	
		Rep 3	29.0	9.8	19.0	0.0973	0.34	1.1704	4.04	0.2810	0.97	0.0745	0.26	0.4170	1.44	
		Rep 4	30.5	10.0	19.5	0.1295	0.42	1.1563	3.79	0.2927	0.96	0.0713	0.23	0.4185	1.37	
		Rep 5	31.5	10.0	19.5	0.0770	0.24	1.1348	3.60	0.2821	0.90	0.0704	0.22	0.4093	1.30	
		Rep 6	30.9	10.3	19.5											
		Rep 7	31.7	10.0	19.5											
		Rep 8	28.4	10.0	19.8											
		Rep 9	32.1	10.0	19.5											
		Rep 10	29.8	9.8	19.3											
		29 weeks of age	Rep 11	33.9	10.0	19.5										
			Rep 12	32.2	9.8	20.0										
			Rep 13	29.9	9.8	19.5										
			Rep 14	30.2	10.0	19.0										
			Rep 15	26.1	9.5	18.5										
			Rep 16	31.9	10.0	18.8										
			Rep 17	27.9	10.0	19.5										
			Rep 18	29.2	9.8	20.0										
Rep 19	31.6		9.8	18.8												
Rep 20	33.1		10.0	19.3												

Table B-21: Raw weight data for the third generation control males. Reps 1-10 were euthanized at 15 weeks of age and Reps 11-20 were euthanized at 18 weeks of age.

		Control													
		Body wt	Body Length	Total Length	Gonads		Liver		Kidney		Spleen		Brain		
					Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight	
Male	15 weeks of age	Rep 1	26.6	9.3	18.5	0.2546	0.96	1.1770	4.42	0.3952	1.49	0.0521	0.20	0.3941	1.48
		Rep 2	28.1	9.5	18.0	0.3067	1.09	1.4177	5.05	0.3791	1.35	0.0681	0.24	0.3931	1.40
		Rep 3	30.5	9.8	19.0	0.3437	1.13	1.3721	4.50	0.4474	1.47	0.0664	0.22	0.4122	1.35
		Rep 4	31.3	9.8	18.8	0.3117	1.00	1.4540	4.65	0.3940	1.26	0.0517	0.17	0.3760	1.20
		Rep 5	32.0	10.0	19.0	0.3215	1.00	1.2694	3.97	0.4631	1.45	0.0575	0.18	0.4026	1.26
		Rep 6	31.4	9.8	19.0										
		Rep 7	29.1	9.5	18.5										
		Rep 8	30.3	9.5	18.5										
		Rep 9	31.3	9.5	18.5										
		Rep 10	31.9	9.8	18.8										
	18 weeks of age	Rep 11	31.2	9.5	18.5										
		Rep 12	31.8	9.5	19.0										
		Rep 13	37.2	9.8	19.0										
		Rep 14	36.1	10.0	19.5										
		Rep 15	35.9	9.8	19.3										
		Rep 16	37.5	9.8	19.3										
		Rep 17	34.3	9.8	19.3										
		Rep 18	35.4	9.8	19.3										
		Rep 19	31.1	9.5	18.5										
		Rep 20	34.7	9.8	19.3										

Table B-22: Raw weight data for the third generation control females. Reps 1-10 were euthanized at 15 weeks of age and Reps 11-20 were euthanized at 18 weeks of age.

		Control													
			Body wt	Body Length	Total Length	Gonads		Liver		Kidney		Spleen		Brain	
						Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight
Female	15 weeks of age	Rep 1	27.5	9.8	19.3	0.0762	0.28	1.6415	5.97	0.3068	1.12	0.0802	0.29	0.4254	1.55
		Rep 2	25.5	9.8	19.0	0.0848	0.33	1.4362	5.63	0.3119	1.22	0.0649	0.25	0.4265	1.67
		Rep 3	27.7	9.8	19.0	0.0781	0.28	1.5564	5.62	0.3300	1.19	0.0814	0.29	0.4293	1.55
		Rep 4	23.2	9.0	17.8	0.0709	0.31	1.2030	5.19	0.2452	1.06	0.0655	0.28	0.3912	1.69
		Rep 5	26.8	9.5	19.0	0.0836	0.31	1.4670	5.47	0.3055	1.14	0.0743	0.28	0.4224	1.58
		Rep 6	26.6	9.8	19.3										
		Rep 7	26.9	9.8	19.8										
		Rep 8	27.1	9.8	19.8										
		Rep 9	27.1	9.8	18.8										
		Rep 10	28.9	10.0	19.0										
	18 weeks age	Rep 11	30.8	9.3	18.5										
		Rep 12	25.3	9.5	18.5										
		Rep 13	29.2	9.8	19.0										
		Rep 14	24.4	9.5	18.5										
		Rep 15	26.8	9.5	19.0										
		Rep 16	27.2	9.3	18.5										
		Rep 17	27.1	9.5	18.5										
		Rep 18	28.5	10.0	19.3										
		Rep 19	28.3	10.0	19.5										
		Rep 20	27.9	9.5	19.0										

Table B-23: Raw weight data for the third generation 0.01 Bq/L males. Reps 1-10 were euthanized at 15 weeks of age and Reps 11-20 were euthanized at 18 weeks of age.

0.01 Bq/L															
			Body wt	Body Length	Total Length	Gonads		Liver		Kidney		Spleen		Brain	
						Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight
Male	15 weeks of age	Rep 1	26.3	9.3	18.0	0.2994	1.14	1.1676	4.44	0.3540	1.35	0.0553	0.21	0.3946	1.50
		Rep 2	34.1	10.0	19.0	0.3509	1.03	1.5117	4.43	0.4774	1.40	0.0652	0.19	0.4184	1.23
		Rep 3	31.5	10.0	18.5	0.3562	1.13	1.3299	4.22	0.4537	1.44	0.0613	0.19	0.4160	1.32
		Rep 4	31.6	10.0	19.0	0.3577	1.13	1.4964	4.74	0.4688	1.48	0.0555	0.18	0.4203	1.33
		Rep 5	31.9	9.8	19.3	0.3466	1.09	1.5624	4.90	0.4619	1.45	0.0638	0.20	0.4165	1.31
		Rep 6	32.6	10.0	19.0										
		Rep 7	30.2	9.8	18.5										
		Rep 8	28.5	9.5	18.5										
		Rep 9	31.8	9.8	18.8										
		Rep 10	29.6	9.3	18.3										
	18 weeks of age	Rep 11	30.7	9.5	18.5										
		Rep 12	31.8	9.8	18.8										
		Rep 13	33.1	9.5	18.5										
		Rep 14	36.5	10.0	19.0										
		Rep 15	35.4	10.3	19.8										
		Rep 16	33.8	9.8	19.0										
		Rep 17	33.1	9.5	18.5										
		Rep 18	33.5	9.8	18.8										
		Rep 19	33.7	9.5	18.5										
		Rep 20	35.0	9.8	18.8										

Table B-24: Raw weight data for the third generation 0.01 Bq/L females. Reps 1-10 were euthanized at 15 weeks of age and Reps 11-20 were euthanized at 18 weeks of age.

0.01 Bq/L															
			Body wt	Body Length	Total Length	Gonads		Liver		Kidney		Spleen		Brain	
						Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight
Female	15 weeks of age	Rep 1	24.7	9.5	18.5	0.0946	0.38	1.0435	4.22	0.2549	1.03	0.0647	0.26	0.4286	1.74
		Rep 2	27.6	9.8	18.8	0.0823	0.30	1.6015	5.80	0.3377	1.22	0.0742	0.27	0.4341	1.57
		Rep 3	24.9	9.5	18.5	0.0775	0.31	1.0196	4.09	0.2684	1.08	0.0582	0.23	0.4238	1.70
		Rep 4	27.2	10.0	18.8	0.0779	0.29	1.2741	4.68	0.2961	1.09	0.0741	0.27	0.4160	1.53
		Rep 5	27.5	9.5	18.8	0.0895	0.33	1.3597	4.94	0.3105	1.13	0.0732	0.27	0.4044	1.47
		Rep 6	26.0	9.5	18.5										
		Rep 7	27.5	9.8	19.0										
		Rep 8	26.0	9.8	19.0										
		Rep 9	26.7	9.8	18.5										
		Rep 10	27.9	9.5	18.5										
	18 weeks of age	Rep 11	30.1	9.8	19.0										
		Rep 12	31.1	9.8	19.0										
		Rep 13	23.1	9.3	18.0										
		Rep 14	26.1	9.5	18.5										
		Rep 15	21.0	9.3	18.0										
		Rep 16	27.7	9.8	19.0										
		Rep 17	26.0	9.5	16.5										
		Rep 18	28.6	9.8	18.5										
		Rep 19	28.1	9.5	18.8										
		Rep 20	28.3	9.8	19.0										

Table B-25: Raw weight data for the third generation 0.1 Bq/L males. Reps 1-10 were euthanized at 15 weeks of age and Reps 11-20 were euthanized at 18 weeks of age.

0.1 Bq/L															
			Body wt	Body Length	Total Length	Gonads		Liver		Kidney		Spleen		Brain	
						Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight
Male	15 weeks of age	Rep 1	33.7	10.0	18.8	0.3251	0.96	1.5816	4.69	0.4534	1.35	0.0608	0.18	0.4207	1.25
		Rep 2	30.7	9.8	18.8	0.3612	1.18	1.4333	4.67	0.4769	1.55	0.0600	0.20	0.4118	1.34
		Rep 3	32.1	9.8	18.5	0.3257	1.01	1.6205	5.05	0.5261	1.64	0.0590	0.18	0.4242	1.32
		Rep 4	33.3	10.3	19.3	0.3729	1.12	1.4090	4.23	0.5204	1.56	0.0693	0.21	0.4259	1.28
		Rep 5	32.9	9.5	19.0	0.3625	1.10	1.7166	5.22	0.5041	1.53	0.0591	0.18	0.4242	1.29
		Rep 6	32.3	10.0	19.0										
		Rep 7	33.2	10.0	18.8										
		Rep 8	30.8	9.5	18.5										
		Rep 9	33.5	10.0	19.0										
		Rep 10	34.3	10.0	19.0										
	18 weeks of age	Rep 11	33.1	9.5	18.5										
		Rep 12	37.3	10.0	19.0										
		Rep 13	34.9	10.0	19.0										
		Rep 14	37.0	9.8	18.8										
		Rep 15	31.6	9.5	18.5										
		Rep 16	34.5	10.0	18.8										
		Rep 17	34.2	9.8	19.3										
		Rep 18	39.4	10.0	19.5										
		Rep 19	34.6	9.8	19.0										
		Rep 20	32.4	9.0	18.8										

Table B-26: Raw weight data for the third generation 0.1 Bq/L females. Reps 1-10 were euthanized at 15 weeks of age and Reps 11-20 were euthanized at 18 weeks of age.

0.1 Bq/L															
			Body wt	Body Length	Total Length	Gonads		Liver		Kidney		Spleen		Brain	
						Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight
Female	15 weeks of age	Rep 1	27.7	10.0	19.3	0.0672	0.24	1.7082	6.17	0.3434	1.24	0.0919	0.33	0.4312	1.56
		Rep 2	26.6	9.8	18.8	0.0688	0.26	1.4742	5.54	0.3306	1.24	0.0788	0.30	0.4394	1.65
		Rep 3	25.8	9.8	19.0	0.0845	0.33	1.3346	5.17	0.3094	1.20	0.0732	0.28	0.4083	1.58
		Rep 4	28.1	9.8	19.3	0.0841	0.30	1.3623	4.85	0.3304	1.18	0.0745	0.27	0.4302	1.53
		Rep 5	27.5	9.8	19.3	0.1029	0.37	1.4393	5.23	0.3113	1.13	0.0700	0.25	0.4358	1.58
		Rep 6	29.7	10.0	19.5										
		Rep 7	31.5	10.0	19.5										
		Rep 8	27.4	10.0	19.5										
		Rep 9	28.2	10.0	19.0										
		Rep 10	27.2	9.5	18.8										
	18 weeks of age	Rep 11	26.3	9.5	19.0										
		Rep 12	30.1	10.0	19.3										
		Rep 13	27.9	10.0	19.0										
		Rep 14	30.0	9.8	18.8										
		Rep 15	27.8	9.8	19.0										
		Rep 16	30.7	10.0	19.0										
		Rep 17	31.7	9.8	18.8										
		Rep 18	29.6	9.8	19.0										
		Rep 19	30.9	9.8	19.0										
		Rep 20	28.6	9.8	19.0										

Table B-27: Raw weight data for the third generation 1.0 Bq/L males. Reps 1-10 were euthanized at 15 weeks of age and Reps 11-20 were euthanized at 18 weeks of age.

1.0 Bq/L															
			Body wt	Body Length	Total Length	Gonads		Liver		Kidney		Spleen		Brain	
						Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight
Male	15 weeks of age	Rep 1	34.0	9.8	19.0	0.3576	1.05	1.7022	5.01	0.5071	1.49	0.0672	0.20	0.4278	1.26
		Rep 2	34.2	10.0	19.3	0.3961	1.16	1.7053	4.99	0.4877	1.43	0.0674	0.20	0.4179	1.22
		Rep 3	31.4	9.8	18.8	0.3593	1.14	1.2419	3.96	0.4561	1.45	0.0530	0.17	0.4281	1.36
		Rep 4	34.1	10.0	19.3	0.4091	1.20	1.6981	4.98	0.4830	1.42	0.0567	0.17	0.4155	1.22
		Rep 5	35.3	9.3	19.8	0.4049	1.15	1.6761	4.75	0.4775	1.35	0.0648	0.18	0.3961	1.12
		Rep 6	31.7	10.0	19.3										
		Rep 7	30.6	9.8	18.8										
		Rep 8	30.3	9.5	18.5										
		Rep 9	31.9	9.8	18.8										
		Rep 10	32.2	9.8	18.5										
	18 weeks of age	Rep 11	31.6	9.5	18.5										
		Rep 12	33.2	9.8	19.0										
		Rep 13	38.4	10.3	19.8										
		Rep 14	36.2	10.0	19.0										
		Rep 15	35.5	10.0	19.5										
		Rep 16	31.6	9.8	18.8										
		Rep 17	36.1	10.0	19.3										
		Rep 18	35.6	9.8	19.0										
		Rep 19	32.3	9.8	19.5										
		Rep 20	33.0	10.0	19.3										

Table B-28: Raw weight data for the third generation 1.0 Bq/L females. Reps 1-10 were euthanized at 15 weeks of age and Reps 11-20 were euthanized at 18 weeks of age.

1.0 Bq/L															
			Body wt	Body Length	Total Length	Gonads		Liver		Kidney		Spleen		Brain	
						Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight
Female	15 weeks of age	Rep 1	25.4	9.8	18.5	0.0860	0.34	1.3010	5.12	0.2840	1.12	0.0699	0.28	0.4209	1.66
		Rep 2	27.7	10.0	19.3	0.0683	0.25	1.5820	5.71	0.3374	1.22	0.0804	0.29	0.4361	1.57
		Rep 3	28.7	10.0	19.3	0.0553	0.19	1.6246	5.66	0.3366	1.17	0.0773	0.27	0.4361	1.52
		Rep 4	25.5	9.5	18.5	0.0644	0.25	1.5011	5.89	0.3022	1.19	0.0732	0.29	0.4000	1.57
		Rep 5	28.1	10.0	19.3	0.0687	0.24	1.4355	5.11	0.3079	1.10	0.0686	0.24	0.4064	1.45
		Rep 6	25.4	9.5	18.8										
		Rep 7	26.6	9.5	18.5										
		Rep 8	24.5	10.0	19.3										
		Rep 9	26.0	9.5	18.5										
		Rep 10	25.4	9.8	19.0										
	18 weeks of age	Rep 11	26.7	9.8	19.3										
		Rep 12	31.0	9.8	19.0										
		Rep 13	26.8	9.5	18.8										
		Rep 14	28.5	9.8	19.0										
		Rep 15	28.3	9.8	19.3										
		Rep 16	31.6	10.0	19.5										
		Rep 17	28.2	9.8	19.0										
		Rep 18	27.9	9.5	18.5										
		Rep 19	31.1	10.0	19.8										
		Rep 20	27.6	9.8	19.0										

Table B-29: Raw weight data for the third generation 10.0 Bq/L males. Reps 1-10 were euthanized at 15 weeks of age and Reps 11-20 were euthanized at 18 weeks of age.

10.0 Bq/L															
			Body wt	Body Length	Total Length	Gonads		Liver		Kidney		Spleen		Brain	
						Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight
Male	15 weeks of age	Rep 1	30.9	9.5	18.5	0.3305	1.07	1.4091	4.56	0.4455	1.44	0.0618	0.20	0.4149	1.34
		Rep 2	32.9	9.8	18.5	0.2963	0.90	1.6251	4.94	0.4997	1.52	0.0661	0.20	0.4261	1.30
		Rep 3	33.3	9.8	18.8	0.2880	0.86	1.5547	4.67	0.4769	1.43	0.0654	0.20	0.4154	1.25
		Rep 4	32.0	9.5	18.5	0.3082	0.96	1.6565	5.18	0.4735	1.48	0.0607	0.19	0.4139	1.29
		Rep 5	30.8	10.0	19.3	0.3526	1.14	1.3181	4.28	0.4620	1.50	0.0728	0.24	0.3964	1.29
		Rep 6	31.3	9.8	18.8										
		Rep 7	27.3	9.5	18.5										
		Rep 8	25.0	9.0	18.0										
		Rep 9	31.6	9.8	18.8										
		Rep 10	28.8	9.8	19.0										
	18 weeks of age	Rep 11	32.4	10.0	19.3										
		Rep 12	30.9	9.5	18.8										
		Rep 13	30.5	9.5	18.8										
		Rep 14	34.1	9.8	19.0										
		Rep 15	33.5	9.3	18.8										
		Rep 16	32.6	9.8	18.8										
		Rep 17	32.4	9.8	19.0										
		Rep 18	32.6	10.0	19.3										
		Rep 19	33.3	9.8	19.0										
		Rep 20	32.9	10.0	19.3										

Table B-30: Raw weight data for the third generation 10.0 Bq/L females. Reps 1-10 were euthanized at 15 weeks of age and Reps 11-20 were euthanized at 18 weeks of age.

10.0 Bq/L															
			Body wt	Body Length	Total Length	Gonads		Liver		Kidney		Spleen		Brain	
						Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight	Weight	% body weight
Female	15 weeks of age	Rep 1	27.8	10.0	19.3	0.0680	0.24	1.3604	4.89	0.3054	1.10	0.0713	0.26	0.4261	1.53
		Rep 2	28.0	10.0	19.0	0.0859	0.31	1.6100	5.75	0.3391	1.21	0.0762	0.27	0.4224	1.51
		Rep 3	25.8	9.8	18.8	0.0775	0.30	1.4503	5.62	0.3126	1.21	0.0735	0.28	0.4104	1.59
		Rep 4	27.9	9.8	19.0	0.0996	0.36	1.5000	5.38	0.3515	1.26	0.0781	0.28	0.4267	1.53
		Rep 5	28.8	10.0	18.8	0.0702	0.24	1.5328	5.32	0.3257	1.13	0.0741	0.26	0.4335	1.51
		Rep 6	25.8	9.8	18.5										
		Rep 7	23.6	9.5	18.5										
		Rep 8	27.0	9.8	19.0										
		Rep 9	26.6	10.0	19.5										
		Rep 10	27.3	10.0	19.0										
	18 weeks of age	Rep 11	30.9	10.0	19.0										
		Rep 12	27.5	9.0	18.0										
		Rep 13	30.9	10.0	19.3										
		Rep 14	30.7	9.8	19.3										
		Rep 15	29.3	9.8	19.0										
		Rep 16	30.8	10.0	19.5										
		Rep 17	27.0	9.8	19.0										
		Rep 18	31.3	10.0	19.3										
		Rep 19	27.4	9.8	19.5										
		Rep 20	30.5	10.0	19.3										

Appendix C

Tables of Raw Average Weight Data for Males and Females of the First, Second, Third and Fourth Generations

Table C-1: Raw average weight data for the first generation of males from 7-42 weeks of age.

	Generation 1, Male										
Treatment	Week										
	7-8	8-9	9-10	11-12	16-17	22-23	26-27	30-31	34-35	35-36	41-42
Control	23.5 ± 1.4	24.1 ± 1.3	25.4 ± 1.3	26.7 ± 1.4	30.6 ± 1.7	35.1 ± 2.1	37.2 ± 2.2	37.9 ± 2.1	38.0 ± 1.8	37.9 ± 2.7	38.8 ± 1.5
0.01 Bq/L	23.9 ± 1.2	24.4 ± 1.1	25.7 ± 1.1	26.9 ± 1.1	31.0 ± 1.4	34.7 ± 1.8	36.6 ± 2.1	37.9 ± 2.0	38.1 ± 2.1	38.5 ± 2.2	37.9 ± 2.2
0.1 Bq/L	24.6 ± 1.6	24.5 ± 1.6	25.8 ± 1.7	27.3 ± 1.9	31.2 ± 2.3	35.4 ± 3.0	37.2 ± 3.2	37.8 ± 3.2	38.2 ± 3.3	39.3 ± 1.9	37.1 ± 3.4
1.0 Bq/L	25.2 ± 1.3	24.9 ± 1.4	26.1 ± 1.5	27.0 ± 1.7	31.0 ± 2.0	34.6 ± 2.0	36.3 ± 2.0	37.2 ± 2.1	37.8 ± 2.0	37.7 ± 1.4	38.0 ± 2.2
10.0 Bq/L	24.8 ± 1.4	24.4 ± 1.4	25.0 ± 2.6	27.3 ± 1.5	31.4 ± 1.7	35.1 ± 2.1	36.5 ± 2.1	37.4 ± 2.0	38.2 ± 2.1	37.5 ± 2.2	38.8 ± 1.9

Table C-2: Raw average weight data for the second generation of males from 6-29 weeks of age.

	Generation 2, Male							
Treatment	Week							
	6-7	7-8	8-9	11-12	15-16	19-20	24-25	28-29
Control	23.4 ± 1.0	24.1 ± 1.2	27.6 ± 1.0	31.8 ± 1.6	34.8 ± 1.9	37.3 ± 1.7	39.4 ± 1.9	38.7 ± 2.1
0.01 Bq/L	25.0 ± 1.9	24.9 ± 2.6	26.2 ± 2.2	29.4 ± 2.8	32.7 ± 3.6	34.3 ± 3.4	35.2 ± 4.3	36.9 ± 3.8
0.1 Bq/L	24.6 ± 2.0	22.2 ± 0.5	27.7 ± 0.8	32.2 ± 0.9	35.4 ± 1.3	37.9 ± 1.5	39.1 ± 1.6	40.0 ± 1.6
1.0 Bq/L	25.4 ± 1.5	25.2 ± 2.0	27.1 ± 1.3	30.5 ± 1.5	34.1 ± 1.6	36.0 ± 1.9	37.6 ± 2.2	37.4 ± 1.7
10.0 Bq/L	24.5 ± 1.3	24.9 ± 1.2	26.0 ± 1.2	29.7 ± 1.8	33.1 ± 1.9	35.0 ± 1.9	35.3 ± 2.7	37.4 ± 2.1

Table C-3: Raw average weight data for the third generation of males from 5-10 weeks of age.

	Generation 3, Male					
Treatment	Week					
	5-6	7-8	8-9	10-11	15-16	18-19
Control	23.7 ± 2.1	26.3 ± 1.4	26.5 ± 1.5	28.2 ± 1.5	30.3 ± 1.8	34.5 ± 2.4
0.01 Bq/L	22.8 ± 1.9	26.2 ± 1.5	26.6 ± 1.4	28.2 ± 1.6	30.8 ± 2.2	33.7 ± 1.7
0.1 Bq/L	23.0 ± 1.9	26.9 ± 1.8	27.5 ± 1.7	30.0 ± 1.8	32.7 ± 1.2	34.9 ± 2.4
1.0 Bq/L	22.8 ± 1.8	27.0 ± 1.0	27.3 ± 1.3	29.4 ± 1.5	32.6 ± 1.7	34.4 ± 2.3
10.0 Bq/L	22.9 ± 2.2	26.0 ± 1.4	25.9 ± 1.3	27.9 ± 1.6	30.4 ± 2.6	32.5 ± 1.1

Table C-4: Raw average weight data for the fourth generation of males from 6-8 weeks of age.

	Generation 4, Male	
Treatment	Week	
	6-7	7-8
Control	23.8 ± 1.1	23.9 ± 1.2
0.01 Bq/L	23.3 ± 1.0	23.6 ± 1.8
0.1 Bq/L	22.5 ± 0.7	23.5 ± 1.3
1.0 Bq/L	22.8 ± 1.2	24.1 ± 1.2
10.0 Bq/L	22.7 ± 0.9	23.7 ± 1.5

Table C-5: Raw average weight data for the first generation of females from 7-42 weeks of age.

Treatment	Generation 1, Female												
	Week												
	7-8	8-9	15-16	19-20	21-22	23-24	25-26	27-28	29-30	31-32	33-34	35-36	41-42
Control	19.4 ± 1.4	20.8 ± 1.2	25.36 ± 1.9	28.2 ± 2.3	29.0 ± 2.5	29.7 ± 2.5	30.5 ± 2.6	N/A	30.8 ± 2.9	31.2 ± 2.9	31.9 ± 3.0	31.2 ± 3.0	33 ± 3.0
0.01 Bq/L	19.7 ± 1.4	21.5 ± 1.3	26.0 ± 2.1	28.6 ± 2.5	29.4 ± 2.2	30.5 ± 2.7	31.2 ± 2.2	31.8 ± 2.3	31.5 ± 2.7	31.9 ± 2.8	32.3 ± 2.8	32.7 ± 3.0	32.7 ± 3.7
0.1 Bq/L	19.8 ± 1.3	21.2 ± 1.2	25.5 ± 1.6	28.1 ± 2.2	28.6 ± 2.4	29.2 ± 2.3	29.8 ± 2.5	30.1 ± 2.7	30.0 ± 2.6	30.6 ± 2.6	31.0 ± 2.9	30.7 ± 3.0	31.9 ± 3.0
1.0 Bq/L	20.5 ± 1.0	21.6 ± 1.2	26.1 ± 2.0	28.4 ± 2.2	30.1 ± 3.1	30.7 ± 3.0	31.7 ± 3.0	31.7 ± 3.1	31.8 ± 3.1	31.7 ± 3.2	31.9 ± 2.9	33.7 ± 2.6	30.6 ± 2.3
10.0 Bq/L	19.0 ± 2.0	20.3 ± 1.4	25.2 ± 1.9	27.0 ± 2.1	27.7 ± 2.3	28.8 ± 2.8	28.7 ± 2.8	29.6 ± 2.5	29.3 ± 2.6	29.7 ± 2.5	30.0 ± 2.8	31.3 ± 1.9	29.4 ± 3.1

Table C-6: Raw average weight data for the second generation of females from 6-30 weeks of age.

Treatment	Generation 2, Female							
	Week							
	6-7	7-8	17-18	19-20	21-22	23-24	25-26	29-30
Control	22.0 ± 1.1	24.4 ± 0.8	30.5 ± 1.7	31.3 ± 1.8	31.1 ± 1.7	31.8 ± 1.9	31.8 ± 2.1	34.3 ± 1.3
0.01 Bq/L	22.0 ± 1.9	23.6 ± 1.4	29.1 ± 2.6	29.9 ± 2.8	30.5 ± 2.6	31.0 ± 2.8	32.5 ± 2.0	31.2 ± 3.3
0.1 Bq/L	21.3 ± 1.3	23.8 ± 1.7	30.8 ± 2.5	30.4 ± 2.7	31.3 ± 2.5	31.9 ± 2.7	32.8 ± 2.0	32.6 ± 3.7
1.0 Bq/L	21.0 ± 1.4	23.9 ± 1.5	29.4 ± 2.1	29.7 ± 2.0	30.5 ± 1.9	30.8 ± 2.0	31.5 ± 2.0	32.6 ± 2.5
10.0 Bq/L	20.4 ± 1.0	23.0 ± 1.0	28.4 ± 1.4	28.7 ± 2.0	29.2 ± 1.7	29.5 ± 1.7	30.7 ± 1.3	30.6 ± 2.4

Table C-7: Raw average weight data for the third generation of females from 5-19 weeks of age.

	Generation 3, Female			
Treatment	Week			
	5-6	7-8	15-16	18-19
Control	20.0 ± 1.0	21.4 ± 1.5	26.7 ± 1.5	27.6 ± 1.8
0.01 Bq/L	18.8 ± 1.2	21.2 ± 1.8	26.6 ± 1.1	27.0 ± 3.1
0.1 Bq/L	19.4 ± 1.4	22.3 ± 1.2	28.0 ± 1.6	29.4 ± 1.7
1.0 Bq/L	18.0 ± 4.7	21.5 ± 1.2	26.3 ± 1.4	28.8 ± 1.8
10.0 Bq/L	18.6 ± 1.9	22.2 ± 1.3	26.9 ± 1.5	29.6 ± 1.7

Table C-8: Raw average weight data for the fourth generation of females from 6-8 weeks of age.

	Generation 4, Female	
Treatment	Week	
	6-7	7-8
Control	19.6 ± 0.7	19.5 ± 1.5
0.01 Bq/L	18.9 ± 0.9	20.1 ± 0.9
0.1 Bq/L	19.2 ± 1.4	19.9 ± 1.0
1.0 Bq/L	18.3 ± 1.4	20.2 ± 1.6
10.0 Bq/L	18.8 ± 1.7	19.0 ± 1.4