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# A COMPARISON OF ORGAN WEIGHT DATA FROM BEACHMICE INHABITING AREAS EITHER TREATED OR UNTREATED WITH A HERBICIDE

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# FOREWORD

This report was prepared by Colorado State University, Fort Collins, Colorado, under Contract No. F0561174-90182.

Dr. George M. Angleton, Associate Professor of Radiation Biology and Biostatistics, Colorado State University (CSU) was program manager at CSU for this research program.

Dr. Alvin L. Young was senior scientist and final program manager for the United States Air Force (USAF) for this contract. Dr. John W. Watters was the original program manager for the USAF. Dr. Louis F. Wailly was responsible for initiating the collaborative effort between CSU and the USAF.

## ABSTRACT

Total body weights and organ weights for beachmice inhabiting an area previously sprayed with a herbicide were compared with weights of beachmice inhabiting an untreated level. No significant effects due to treatment were detected at the 0.05 level of significance.

## Introduction

Vegetative growth was essentially removed from a test area following intense spraying of the area with a herbicide. Three years later vegetative growth was approaching pre-treatment levels. The beachmouse, peromyscus polionotus, was a natural inhabitant of the area prior to the treatment. It was also observed to be present during the recovery process. Accordingly, the beachmouse became an animal upon which studies could be performed in evaluating the hazards associated with the spraying of the herbicide.

## Procedures

Mice were randomly trapped from each of two test areas. The first area was designated the control area. The second area which had been heavily sprayed with a herbicide in 1969 and 1970 was designated as the test areas. Specimens were collected in the years 1973 and 1974. All animals were necropsied with total body weights and organ weights being recorded.

The residual ecological impact of the herbicide treatment upon the inhabitants of the sprayed areas was, in part, evaluated by a comparison of the weights so obtained for inhabitants of the test area with those of the control area.

The resultant data are tabulated in Table 1 for the control animals and in Table 2 for the test animals. Tables 3, 4, 5, 6, 7, and 8 are analysis of variance tables which summarize the results of the analyses with respect to the cited mathematical models.

The respective hypotheses of no effects due to treatment, body weight or sex upon heart weight can not be rejected when tested at the 0.05 level of significance. The levels at which these effects become significant as given in Table 3 do not approach the 0.05 level.

In a similar manner hypotheses of no effect due to treatment, body weight or sex upon lung weight also have to be rejected according to their respective levels of significance as given in Table 4. In the case of the analysis of liver weight data as given in Table 5, the effect due to treatment is significant at the 0.08 level of significance but not at the 0.05 level. Hence, the hypothesis of no effect due to treatment is accepted, but with a slight degree of reservation. It is interesting to note the significant effects due to body weight, sex and year were simultaneously noted with the

levels of significance for these tests being less than 0.001.

The results of the analyses for the spleen weights are summarized in Table 6. As may be noted, there does not appear to be any significant effect due to treatment, or for that matter due to either body weight or sex. The results of the analyses for the kidney weights are summarized in Table 7. Again at the 0.05 level of significance there is no significant effect due to treatment or for that matter sex. However, there is a significant dependence of kidney weight on body weight.

The final analysis of variance table, Table 8, is used to test the hypothesis of no effect of treatment on total body weight. Again, there does not appear to exist any significant effect due to treatment. However, as might be expected, a significant effect due to sex differences does exist.

## Summary

Total body weight and organ weights of beachmice randomly trapped from a control area were compared with those from a test area previously treated with a herbicide. No significant differences attributable to the herbicide treatment were detected for statistical tests conducted at the five percent (0.05) level of significance.

TABLE 1

BODY WEIGHT AND ORGAN WEIGHT DATA FOR CONTROL SUBJECTS. DATA FOR PREGNANT FEMALES AND FOR MICE WITH TOTAL BODY WEIGHTS LESS THAN 10 GRAMS ARE NOT LISTED.

| Year | Sex | Body Weight -gms- | - - - - - - - Organ Weights (mg.) - - - - - - - | | | | |
|---|---|---|---|---|---|---|---|
| | | | Heart | Lungs | Liver | Spleen | Kidney |
| 1973 | M | 12.86 | 70 | --- | 660 | --- | --- |
| 1973 | M | 11.90 | 70 | --- | 750 | --- | --- |
| 1973 | M | 12.30 | 70 | --- | 880 | --- | --- |
| 1973 | M | 10.44 | 100 | --- | 540 | --- | --- |
| 1974 | M | 14.65 | 108 | 119 | 811 | 17 | 226 |
| 1974 | M | 12.62 | 93 | 68 | 778 | 12 | 183 |
| 1974 | F | 11.61 | 77 | 99 | 642 | 26 | 171 |
| 1974 | M | 12.66 | 113 | 108 | 524 | 21 | 199 |
| 1974 | F | 12.55 | 85 | 164 | 688 | 16 | 223 |
| 1974 | M | 12.59 | 96 | 112 | 495 | 14 | 207 |
| 1974 | F | 10.23 | 84 | 88 | 679 | 25 | 170 |
| 1974 | M | 10.44 | 84 | 94 | 580 | 16 | 174 |
| 1974 | M | 11.70 | 130 | 92 | 537 | 16 | 195 |
| 1974 | M | 12.75 | 105 | 102 | 530 | 20 | 174 |
| 1974 | M | 11.72 | 90 | 100 | 726 | 15 | 211 |
| 1974 | M | 11.45 | 100 | 96 | 548 | 20 | 171 |
| 1974 | M | 11.05 | 90 | 87 | 549 | 4 | 203 |
| 1974 | M | 10.55 | 97 | 107 | 643 | 30 | 161 |
| 1974 | F | 12.67 | 121 | 106 | 704 | 20 | 225 |

TABLE 2, Page 1

BODY WEIGHT AND ORGAN WEIGHT DATA FOR TEST SUBJECTS. DATA FOR PREGNANT FEMALES AND FOR MICE WITH TOTAL BODY WEIGHTS LESS THAN 10 GRAMS ARE NOT LISTED.

| Year | Sex | Body Weight -gms- | - - - - - - - Organ Weights (mg.) - - - - - - - | | | | |
|---|---|---|---|---|---|---|---|
| | | | Heart | Lungs | Liver | Spleen | Kidney |
| 1973 | M | 12.59 | 100 | --- | 450 | --- | --- |
| 1973 | F | 14.20 | 80 | --- | 1150 | --- | --- |
| 1973 | M | 11.50 | 30 | --- | --- | --- | --- |
| 1973 | M | 11.36 | 110 | --- | --- | --- | --- |
| 1973 | F | 15.43 | 70 | --- | 1300 | --- | --- |
| 1973 | M | 13.72 | 90 | --- | 850 | --- | --- |
| 1973 | M | 10.70 | 90 | --- | 940 | --- | --- |
| 1973 | M | 13.81 | 100 | --- | 1300 | --- | --- |
| 1973 | F | 14.59 | 80 | --- | 1290 | --- | --- |
| 1973 | F | 16.01 | 100 | --- | 1450 | --- | --- |
| 1973 | M | 10.48 | 70 | --- | 760 | --- | --- |
| 1973 | M | 12.16 | 90 | --- | 570 | --- | --- |
| 1973 | M | 13.50 | --- | --- | --- | --- | --- |
| 1973 | F | 10.00 | 80 | --- | 560 | --- | --- |
| 1973 | F | 10.79 | 100 | --- | 1140 | --- | --- |
| 1973 | M | 12.43 | 100 | --- | 1150 | --- | --- |
| 1973 | F | 13.93 | 80 | --- | 1450 | --- | --- |
| 1973 | F | 11.30 | 70 | --- | 580 | --- | --- |
| 1973 | M | 11.28 | 80 | --- | 800 | --- | --- |
| 1973 | M | 12.45 | 80 | --- | 930 | --- | --- |

TABLE 2, Page 2

BODY WEIGHT AND ORGAN WEIGHT DATA FOR TEST SUBJECTS. DATA FOR PREGNANT FEMALES AND FOR MICE WITH TOTAL BODY WEIGHTS LESS THAN 10 GRAMS ARE NOT LISTED.

| Year | Sex | Body Weight -gms- | - - - - - - - Organ Weights (mg.) - - - - - - - | | | | |
|---|---|---|---|---|---|---|---|
| | | | Heart | Lungs | Liver | Spleen | Kidney |
| 1974 | M | 10.06 | 73 | 80 | 529 | 14 | 187 |
| 1974 | M | 13.63 | 97 | 112 | 696 | 11 | 196 |
| 1974 | M | 11.49 | 113 | 103 | 824 | 29 | 201 |
| 1974 | M | 12.25 | 97 | 124 | 696 | 16 | 234 |
| 1974 | M | 11.26 | 112 | 92 | 419 | 10 | 179 |
| 1974 | F | 15.57 | 111 | 90 | 926 | 17 | 216 |
| 1974 | F | 16.32 | 108 | 82 | 1044 | 55 | 241 |
| 1974 | M | 10.05 | 149 | 124 | 436 | 12 | 204 |
| 1974 | F | 12.25 | 114 | 121 | 737 | 11 | 197 |
| 1974 | M | 11.74 | 70 | 85 | 797 | 45 | 191 |
| 1974 | M | 11.09 | 84 | 81 | 635 | 9 | 174 |
| 1974 | M | 11.63 | 82 | 84 | 750 | 35 | 204 |
| 1974 | M | 10.61 | 102 | 151 | 645 | 17 | 174 |
| 1974 | F | 12.05 | 85 | 91 | 734 | 16 | 252 |
| 1974 | M | 12.07 | 92 | 96 | 902 | 28 | 232 |
| 1974 | M | 11.30 | 85 | 89 | 587 | 25 | 171 |
| 1974 | M | 12.21 | 75 | 80 | 847 | 58 | 173 |
| 1974 | M | 11.46 | 84 | 98 | 544 | 14 | 189 |

TABLE 3

ANALYSIS OF VARIANCE TABLE FOR HEART WEIGHTS FOR FIELD BEACHMOUSE DATA. DATA FOR PREGNANT FEMALES AND FOR MICE WITH TOTAL BODY WEIGHTS LESS THAN 10 GRAMS EXCLUDED FROM THE ANALYSIS

| Source of Variation | Degrees of Freedom | Sum of Squares | Mean Squares | Test Statistic $-F_s-$ | Level of Significance $P\{F>F_s\}$ |
|---|---|---|---|---|---|
| Observations | 56 | 486,160.0000 | | | |
| Model | 5 | 470,417.3081 | | | |
| Mean | 1 | 467,383.1424 | | | |
| Year | 1 | 2,697.6582 | | | |
| Sex | 1 | 1.0493 | 1.0493 | 0.003 | 0.957 |
| Body Wt. | 1 | 334.7756 | 1.0845 | 1.085 | 0.304 |
| Treatment | 1 | 0.6821 | 0.6821 | 0.002 | 0.963 |
| Error | 51 | 15,742.6919 | 308.68 | | |

TABLE 4

ANALYSIS OF VARIANCE TABLE FOR LUNG WEIGHTS FOR FIELD BEACHMOUSE DATA. DATA FOR PREGNANT FEMALES AND FOR MICE WITH TOTAL BODY WEIGHTS LESS THAN 10 GRAMS EXCLUDED FROM THE ANALYSIS

| Source of Variation | Degrees of Freedom | Sum of Squares | Mean Squares | Test Statistic $-F_s-$ | Level of Significance $P\{F>F_s\}$ |
|---|---|---|---|---|---|
| Observations | 33 | 350,007.00 | | | |
| Model | 4 | 337,384.13 | | | |
| Mean | 1 | 337,037.12 | | | |
| Sex | 1 | 174.44 | 174.44 | 0.40 | 0.532 |
| Body Weight | 1 | 38.14 | 38.14 | 0.09 | 0.766 |
| Treatment | 1 | 134.43 | 134.43 | 0.31 | 0.582 |
| Error | 29 | 12,622.87 | 435.27 | | |

TABLE 5

ANALYSIS OF VARIANCE TABLE FOR LIVER WEIGHTS FOR FIELD BEACHMOUSE DATA. DATA FOR PREGNANT FEMALES AND FOR MICE WITH TOTAL BODY WEIGHTS LESS THAN 10 GRAMS EXCLUDED FROM THE ANALYSIS

| Source of Variation | Degrees of Freedom | Sum of Squares | Mean Squares | Test Statistic $-F_s-$ | Level of Significance $P\{F>F_s\}$ |
|---|---|---|---|---|---|
| Observations | 52 | 34,592,585. | | | |
| Model | 5 | 33,279,682. | | | |
| Mean | 1 | 31,125,642. | | | |
| Year | 1 | 845,190. | 845,190. | 30.256 | <0.001 |
| Sex | 1 | 483,959. | 483,959. | 17.325 | <0.001 |
| Body Weight | 1 | 734,901. | 734,901. | 26.308 | <0.001 |
| Treatment | 1 | 89,989. | 89,988 | 3.22 | 0.0792 |
| Error | 47 | 1,312,903. | 27,934 | | |

TABLE 6

ANALYSIS OF VARIANCE TABLE FOR SPLEEN WEIGHTS FOR FIELD BEACHMOUSE DATA. DATA FOR PREGNANT FEMALES AND FOR MICE WITH TOTAL BODY WEIGHTS LESS THAN 10 GRAMS EXCLUDED FROM THE ANALYSIS

| Source of Variation | Degrees of Freedom | Sum of Squares | Mean Squares | Test Statistic $-F_s-$ | Level of Significance $P\{F>F_s\}$ |
|---|---|---|---|---|---|
| Observations | 33 | 19,418.00 | | | |
| Model | 4 | 15,123.36 | | | |
| Mean | 1 | 14,595.00 | | | |
| Sex | 1 | 52.03 | 52.03 | 0.35 | 0.559 |
| Body Weight | 1 | 262.61 | 262.61 | 1.77 | 0.195 |
| Treatment | 1 | 213.69 | 213.69 | 1.44 | 0.241 |
| Error | 27 | 4,294.64 | 148.09 | | |

TABLE 7

ANALYSIS OF VARIANCE TABLE FOR KIDNEY WEIGHTS FOR FIELD BEACHMOUSE DATA. DATA FOR PREGNANT FEMALES AND FOR MICE WITH TOTAL BODY WEIGHTS LESS THAN 10 GRAMS EXCLUDED FROM THE ANALYSIS

| Source of Variation | Degrees of Freedom | Sum of Squares | Mean Squares | Test Statistic $-F_s-$ | Level of Significance $P\{F>F_s\}$ |
|---|---|---|---|---|---|
| Observations | 33 | 1,594.832. | | | |
| Model | 4 | 1,582,099. | | | |
| Mean | 1 | 1,571,782. | | | |
| Sex | 1 | 3,010. | 3,010 | 6.85 | 0.014 |
| Body Weight | 1 | 5,998. | 5,998 | 13.66 | <0.001 |
| Treatment | 1 | 1,309. | 1,309 | 2.98 | 0.095 |
| Error | 29 | 12,732. | 439 | | |

TABLE 8

ANALYSIS OF VARIANCE TABLE FOR TOTAL BODY WEIGHTS FOR FIELD BEACHMOUSE DATA. DATA FOR PREGNANT FEMALES AND FOR MICE WITH TOTAL BODY WEIGHTS LESS THAN 10 GRAMS EXCLUDED FROM THE ANALYSIS

| Source of Variation | Degrees of Freedom | Sum of Squares | Mean Squares | Test Statistic $-F_s-$ | Level of Significance $P\{F>F_s\}$ |
|---|---|---|---|---|---|
| Observations | 58 | 8,742.1315 | | | |
| Model | 4 | 8,630.5108 | | | |
| Mean | 1 | 8,610.5303 | | | |
| Year | 1 | 2.3668 | 2.3668 | 1.1450 | 0.289 |
| Sex | 1 | 17.2892 | 17.2892 | 8.3642 | 0.006 |
| Treatment | 1 | 0.3246 | 0.3246 | 0.1570 | 0.694 |
| Error | 54 | 111.6207 | 2.0671 | | |