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INFLUENCE OF CHRONIC RESTRAINT ON GASTROINTESTINAL FUNCTION IN THE RAT

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Final Technical Report

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Introduction

It was previously shown by Pfeiffer[1] at the Ames Laboratory, and again in this laboratory,[2] that when the body movement of rats was severely restricted growth was impaired. Our previous studies under this contract on the absorption of sodium, chloride, calcium and water did not indicate that chronic restraint adversely affected that function. That does not, however, indicate that all functions under conditions of restraint are normal, only that the intestine is capable of absorbing nutrients presented to it. There might still be a defect induced in the function responsible for making nutrients available to the absorbing surface of the small intestine which could explain the effect of restraint on growth. Those functions responsible for that process, gastric emptying and intestine motility were evaluated in the present studies along with the effect of dietary alterations on those functions.

Since space travelers may also be exposed to radiation of varying intensities and doses, and since it is already known that acute irradiation of the whole body, the abdomen or the head results in a delay in gastric

emptying after as small a dose as 25 R,[3] the effect of both chronic irradiation and restraint upon intestinal function should be determined, particularly when it is realized that such exposures may be encountered over a period of days rather than in a single acute exposure.

Experiments were performed such that the effect of restraint upon body weight and upon gastrointestinal function (i.e., gastric emptying time and/or intestinal movement) could be studied. Restrained and non-restrained rats were placed on a normal diet, a high-fat content diet, or a low-fat content diet from the beginning of restraint until the animal was sacrificed in order to observe consequent effects. Additional restrained and non-restrained rats on a normal diet were subjected to continuous ^{60}Co exposure totaling either ∿50 R/day (±5%) or ∿300 R/day (∿5%) from the beginning of restraint until the time of sacrifice.

The animals used in this experiment were male Charles River strain CD rats. All rats were held in isolation quarters for 2 weeks after receipt to determine the presence of any disease before being placed in stock or experimental animal rooms. The rats were then caged individually for at least 1 to 2 weeks prior to being placed on experiment. Restraint cages were of the same design as those used by Pfeiffer[1] and the procedures employed have been reported previously[2]. At all times and in all series of experiments the non-restraining rat cages were alternated with the restraint cages. Water was permitted ad libitum; food was permitted ad libitum except when indicated otherwise.

All rats were weighed daily, including week-ends. The space in the restraining cage was corrected daily, if necessary, according to the weight of the animal. Pertinent clinical parameters were noted, and food and water were changed daily.

Three sets of experiments were undertaken:

1. Influence of chronic restraint upon gastrointestinal function

Restrained and non-restrained rats were caged individually for periods of time varying from 1 to 31 days as shown in Table I. Restraint was commenced in the morning, with pellets of normal rat diet[a] permitted ad libitum until the evening prior to the last morning of restraint, at which time all food was removed from the animals. They were fasted overnight in an attempt to insure relatively uniform conditions in the gastrointestinal tract.

On the morning of the function test the rats were allowed food ad libitum from 30 min prior to the intragastric administration of ∿0.5 ml of ^{106}Ru chloride and throughout the remainder of the experiment. (^{106}Ru is a non-absorbed beta-emitting isotope of 0.04 MeV maximum energy.) The characteristics and the metabolism of ^{106}Ru chloride have been investigated and published.[4,5] One ml of H_2O was used to flush the stomach tube before the animals were returned to their cages. Restrained and non-restrained animals were sacrificed at sequential intervals following administration of the isotope.

Rats were killed by decapitation at the intervals indicated in Table I. The entire gastrointestinal tract was carefully removed from each animal,

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[a]Normal Rat Diet: Baked D&G Research Animal Laboratory Diet for Rats and Mice. The Price-Wilhoite Co., Frederick, Md.

placed on wax paper and frozen, thereby preventing translocation of luminal contents and preserving the tissue for later use. At a later time each gut was placed upon a sheet of Kodak No-Screen Readi-Pak X-ray film for autoradiography. These exposures varied in time from 90 to 960 min, depending upon the postadministration time interval prior to sacrifice.

Subsequently, each gut was divided into at least 10 sections for determination of the isotope content. The small intestine was divided into four equal lengths, and the large intestine was divided into two segments of equal length. Both the stomach and the cecum were divided into at least two sections each; however, counts were combined such that single totals were obtained for the stomach and for the cecum. Cross-contamination of the sectioning process was minimized by using a clean razor blade for each cut. Sections were placed in individual counting tubes and the ^{106}Ru content determined by direct count using a 3" sodium iodide thallium-activated crystal well-counter shielded by lead. The amount of radioactivity in each segment of the gut was compared to the total quantity injected and a percentage was obtained; the total percentage of isotope retained in the entire gastrointestinal tract was also calculated.

2. Influence of altered diet--either low-fat content or high-fat content--on gastrointestinal function of restrained and of non-restrained rats

Rats were treated as indicated previously except that at the time at which rats were placed on experiment (in either restraint or in non-restraint cages) their diet was changed from that of normal rat food

pellets (5% fat) to either a low-fat content diet[a] (0% fat) or a high-fat content diet[b] (45.5% fat). The low-fat content diet was in a pelleted form and therefore presented no unique problems in feeding. The high-fat content diet, however, could not be given in pellet form because the high quantity of fat in the diet resulted in a slurry which, upon standing, separated into solid material and oil. This food was therefore thoroughly mixed daily prior to feeding the rats.

Because of this the restraint cages had to be modified slightly. Instead of being able to place the food directly in the cage, as in the case of the pelleted normal diet and the low-fat content diet, or in a small container within the cage, as in the case of the non-restrained rats on a high-fat content diet, a metal bin was constructed such that it could be placed on the side of the restraint cage, permitting the rat to reach the food with his head, but essentially retaining the same physical dimensions as the other restraint cages.

Restrained and non-restrained rats were maintained on these diets for periods of time comparable to those rats on a normal diet (see Table I) and were sacrificed at the postadministration times indicated. Administration of ^{106}Ru, sacrifice of the rat and analysis of its gastrointestinal tract were identical to that indicated above.

The diets were comparable with respect to the protein, vitamin and salt content. The high-fat diet contained less carbohydrate than did the normal diet (29% vs. 51%), and the low-fat diet contained increased quantities of both carbohydrate (58.5% vs. 51%) and cellulose (16.5% vs. 4.5%).

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[a] "Fat Free" Test Diet, Nutritional Biochemicals Corp., Cleveland, Ohio
[b] "High Fat" Test Diet, Nutritional Biochemicals Corp., Cleveland, Ohio

3. Influence of continuous irradiation on the gastrointestinal function of restrained and non-restrained rats.

Rats were placed in restraint and control cages which were positioned around a ^{60}Co source and exposed to either 0 R, 50 R or 300 R/day continuous ^{60}Co exposure for various periods of time as indicated in Table I. Dosimetry measurements were based upon Victoreen R-chamber readings and upon lithium flouride capsules which were calibrated against the R-chambers. Lithium flouride capsules were implanted subcutaneously under the abdominal skin in a number of animals in order to verify that the dose actually received was comparable to that measured in air. The rats were irradiated for 23 hr daily, with the source being lowered for one hour for animal care and weighing. Because of physical limitations (the size of the ^{60}Co exposure room, the need for using different sources for the two dose levels, the size of the cages and racks in relationship to the dose distribution in the exposure room, etc.) the number of animals which could be placed on experiment at any one time was necessarily restricted. Groups of animals therefore had to be exposed separately at different times.

At the conclusion of the exposure period, the restrained and the non-restrained rats were injected intraduodenally with ^{106}Ru chloride to avoid the complications due to possible gastric retention at these dose levels. Two or three sutures and a skin clip were usually adequate to close the mid-line incision. A restrained and a non-restrained rat were sacrificed at various intervals after injection (Table I), and the GI tract was treated as previously indicated.

Intestinal Flora: Influence of Restraint

Counts of coliform bacteria were made on jejunal and ileal segments of the intestine of rats as reported by Mahony, et al.[7] Both restrained and non-restrained animals were killed either 7 days or 21 days after being placed on restraint while on a normal diet and after 21 days of restraint while on a high-fat content diet. After sacrifice the intestine was divided into three equal segments with the upper and lower segments being utilized for bacterial counts. Using sterile technique, the longitudinally opened intestine and its contents were placed in a 10 cc. sterile saline bottle and agitated for at least 20 min in a constant temperature water bath shaker after which four serial dilutions of the lumen content were made, each dilution being that of 100 to 1. One cc. from each dilution was then placed into a Petri dish to which was added about 20 cc. of McConkey's medium. Contents were well-mixed and were permitted to stand overnight in a temperature controlled incubator before being counted the following day.

Results

The daily weight was compared to the pre-exposure weight, and an increase (>100%) or decrease (<100%) of weight was calculated for each animal for each day. A mean percentage value was then obtained using values from all animals on experiment during a given day of restraint. These data are plotted in Fig. 1 for the animals on a normal diet, a low-fat content diet, or a high-fat content diet, and in Fig. 3 for the animals on a normal diet which were sham-irradiated or exposed to 50 R or 300 R/day. The number of rats available for such a mean determination decreased with increased time because animals were removed periodically for isotope administration and sacrifice. It should be noted that the weight of animals

obtained on their final morning of restraint (just prior to isotope administration) was not included in the data because they had been fasted during the previous night.

The differences between the mean percentage values were tested for statistical significance by analysis of variance (F test). This procedure is analogous to a two-tailed t-test (i.e., $\sqrt{F} = t$). Since each individual statistical test was not independent (i.e., data from all animals was pooled at each day) animals sacrificed at specific intervals were tested separately (Mann-Whitney "U" test).[6] These results were in agreement with those shown in Tables II-V.

The percentage weight changes between the restrained and the non-restrained rats on a regular diet (Fig. 1 and Table II) were statistically significant up to and including the twenty-third day of restraint. The non-significance of the difference between the two groups of animals thereafter was due mainly to the large standard error in the non-restrained animals caused primarily by one rat which did not gain weight as rapidly as did the remaining rats in that group (as indicated by the comparatively large standard error at these times).

The mean percentage weight gain or loss between groups of restrained and of non-restrained rats fed a low-fat content diet consistently was significantly different at all except intermittant time intervals.

Restrained and non-restrained rats on a high-fat content diet showed a statistically significant difference in weight changes at all times throughout the experiment.

The mean percentage difference between the weight changes of restrained and non-restrained rats on a normal diet, and on a low-or a high-fat content diet are shown in Fig. 2. While a statistical comparison of these values was not possible, it can readily be noted that there was little difference in the mean percentage differences between the animals on a normal diet and those on a low-fat diet, and that there was a considerably greater difference in the mean percentage differences between those animals on a high-fat content diet and those on either of the other two diets. The standard error of the difference between the means was included at 5-day intervals.

At all intervals the mean percentage increase in weight of non-restrained animals on a low-fat content diet was less than that of the non-restrained rats on a normal diet, whereas the non-restrained animals on a high-fat content diet showed a percentage weight increase comparable to the non-restrained animals on a regular diet. The restrained rats showed the greatest mean percentage increase in weight while on a regular diet, the restrained rats on a high-fat content diet consistantly showed a weight which was less than their initial weight (<100%), and the restrained rats on a low-fat content diet showed weight changes intermediate between these two patterns: a decrease in weight until about the twelfth day, after which time there was generally an increase in weight above the initial weight, although at no time did this increase approach the weight increases shown by the corresponding non-restrained rats.

It is of interest to note the relative increases or changes in weight of the various groups. The decreasing order of relative weight gain is shown in Table VI.

TABLE VI

RELATIVE WEIGHT GAIN AS A FUNCTION OF DIET AND BODY MOVEMENT
(Decreasing Order)

Diet	Body Movement
High fat or normal	Non-restrained
Normal	Restrained
Low fat	Non-restrained
Low fat	Restrained
High fat	Restrained

The daily weights of restrained and non-restrained rats placed in the ^{60}Co room and exposed to 0 R, ∿50 R or ∿300 R/day are shown in Fig. 3 as a percentage of their initial weight. There was little difference in weight changes during days 1-9 between the 0 R control rats and the rats exposed to 50 R/day. Not until day 9 did the non-restrained rats receiving 50 R/day begin to differ from the non-restrained sham-irradiated rats. Similarly, it was not until day 8 that the restrained rats receiving 50 R/day differed from the restrained sham-irradiated rats. In both the 0 R and 50 R/day groups the weight of the restrained rats as a percentage of their initial weight was significantly different from the same parameter in the respective control groups on almost all days. The animals receiving 300 R/day consistently lost greater amounts of weight than did either of the other two groups. There was no significant difference between the response of the restrained and the non-restrained rats at this dosage level.

The difference in mean percentage weight gains between restrained and non-restrained rats in each of the three dosage groups is presented in Fig. 4. Except for the first day of restraint or non-restraint the difference in the mean percentage weight gains between the restrained and the non-restraint rats receiving either 0 R/day or 50 R/day was quite similar. Exposure to 300 R/day, however, tended to reduce the difference in mean percentage weight changes between the restrained and non-restrained rats.

The distribution and relative quantity of ^{106}Ru in various portions of the gastrointestinal tract were compared and evaluated according to several criteria. Comparison was made of the total quantity of isotope remaining in the gastrointestinal tract of restrained and of non-restrained rats sacrificed at identical intervals following administration of the isotope. Data from restrained and non-restrained animals on either a normal diet, a high-fat diet, or a low-fat diet, are shown in Table VII; data from irradiated animals are shown in Table VIII.

Low values were encountered occasionally amongst both restrained and non-restrained groups of animals, but there was no consistent pattern to them, and they may be attributed either to a faulty injection technique, or in some cases to the fact that the animal had defecated shortly before being sacrificed.

There does not appear to be any significant difference between the restrained and the non-restrained groups of animals in the amount of isotope

retained in the animals after various time intervals following isotope administration regardless of the particular diet regimen. Similarly there does not appear to be any progressive or consistent change as the length of the restraint period was increased. Further there appears to be no significant difference between either the restrained or the non-restrained animals on the various diets.

Animals receiving 0, 50 or 300 R/day likewise show no obvious or consistent differences, either between restrained or non-restrained animals at a given dosage level, or between restrained animals at different dosage levels, or between non-restrained animals at different dosage levels. There likewise appears to be no difference between the restrained and the non-restrained rats either with increasing time after injection of the isotope or with increasing periods of restraint and exposure to continuous ^{60}Co irradiation. Experiments were not carried out beyond the 9-day exposure period because the majority of the animals receiving 300 R/day died on the tenth and eleventh day of exposure.

The quantity of isotope retained in stomachs in those groups of animals which were given the isotope via a stomach tube is an indication of a function which may be affected. This data, presented in Table IX, shows that animals either on a high-fat content diet or a low-fat content diet usually retained a substantial portion of the contents within the stomach for a longer period of time than did those animals on a normal diet. This was true both for restrained and for non-restrained animals. For example, at

6 hr after injection following 3 days of restraint, restrained and non-restrained animals on a normal diet had 2% and 0% of the isotope, respectively, remaining in their stomachs, whereas the restrained and non-restrained animals on a low-fat content diet retained 38% and 32%, respectively, and the animals on a high-fat content diet retained 22% and 47%, respectively. This observation was most noticeable beyond the 2-hr sacrifice period following the isotope administration.

There did not appear to be any significant or consistent difference in the amount of isotope retained in the stomach when comparing restrained and non-restrained animals on a normal diet. Although there are a number of striking exceptions, the non-restrained animals generally retained an amount approximately equal to, or greater than, the restrained animals for the same time period. Nevertheless, considering the days of restraint, the time of sacrifice after administration of the isotope, and the distribution of those comparisons in which there was a large difference, there did not appear to be any pattern from which one could generalize with respect to the effect of restraint upon gastric retention.

On the other hand, the non-restrained animals on the low-fat content diet almost uniformly showed a greater gastric retention at all times after isotope administration than did the restrained animals on a low-fat content diet, with the exception of those animals restrained for a period of 31 days and/or those animals sacrificed 0.5 hr after isotope administration. Although there are a few exceptions to this generalization, these exceptions between

the restrained and non-restrained animals are, for the most part, small in magnitude and within the range of experimental error.

Those animals on a high-fat content diet even more clearly demonstrated that the non-restrained rats retained a higher percentage of the administered isotope in the stomach than did the restrained rats. There was one consistent exception to this statement: after 5 days of restraint on a high-fat diet, the restrained animals showed a greater retention than did the non-restrained animals. After all other periods of restraint, and at all time intervals following isotope administration, with the single exception of the 1/2-hour sacrifice period after 18 days restraint, the non-restrained rats showed an increased retention of the isotope compared to the retention exhibited by the restrained animals.

Comparisons utilizing this data show that, in addition to the generalized statement previously made with respect to the retention of the isotope between restrained and non-restrained animals on a high-fat or a low-fat diet as compared to those animals on a normal diet, it can also be stated that the non-restrained animals on a high-fat content diet exhibited greater gastric retention after 1 and 3 days on experiment than did corresponding groups of non-restrained animals on a low-fat content regimen. After 5 days of restraint the non-restrained animals on a low-fat diet showed greater gastric retention than did the animals on a low-fat diet. After longer periods of restraint there was no obvious difference in the gastric retention of non-restrained animals.

The comparable situation with respect to the restrained animals did not follow the same patterns. The restrained animals on a low-fat content diet exhibited comparable or greater isotope gastric retention than did the restrained animals on a high-fat content diet. There were only two or three significant deviations from this statement, namely the values indicated on day 1 at 0.5 hr and 2 hr following isotope administration and at 2 hr following administration after 3 days of restraint.

The eight sections of the gastrointestinal tract were examined for the distribution of the isotope down the length of the gut at sequential intervals following administration of the isotope after various periods of restraint. Comparisons were made between restrained and non-restrained animals on the various diets (Table IX) and after various doses of irradiation (Table X) and among restrained animals under the several experimental conditions and among non-restrained animals under the several experimental conditions. Analyses of the data indicate that there was little difference between restrained and non-restrained animals on a normal diet with respect to the distribution of the ^{106}Ru in the gastrointestinal tract regardless of the hours elapsed since the time of administration of the isotope or of the length of restraint prior to administration of the isotope. Although differences were noted between restrained and non-restrained animals at specific time intervals after administration of the isotope, notably at 0.5 hr and at 2 hr following administration, there did not appear to be any consistent pattern in these deviations; at times the restrained animals showed more rapid movement of the isotope while at

other times the non-restrained animals showed more rapid movement of the isotope. The largest and most consistent difference between restrained and non-restrained animals was seen at 9 days after restraint and at 0.5 hr and 2 hr after isotope administration. It should be noted that in most cases there was comparatively little isotope in the first segment of the small intestine 0.5 hr after intragastric administration of the isotope, the majority of the isotope being either in the stomach or in the second or third segments of the small intestine. At 2 hr the animals on a normal diet exhibit their greatest isotope concentration in either the third or fourth segment of the small intestine. Beyond 2 hr the isotope remained mainly in the cecum of the animals, with generally little difference between restrained and non-restrained animals.

Comparison of isotope distribution in the gut of restrained and non-restrained animals on a high-fat content diet often showed that the isotope moved down the gastrointestinal tract more rapidly in the restrained animals than in the non-restrained animals, particularly on days 1, 6 and 9, and to a lesser extent on day 18. This was also noted at the 0.5 hr time period after injection on day 3. Animals sacrificed after 5 days of restraint did not show or exhibit this effect.

It should also be noted that, similar to the animals on the normal diet, 0.5 hr after administration the majority of the isotope was located either in the stomach or in the second or third segment of the small intestine; whereas, at 2 hr the majority of the isotope, aside from stomach content, was found almost exclusively in the fourth segment of the small intestine in the animals on a high-fat content diet.

The restrained and non-restrained animals on a low-fat content diet did not exhibit consistent differences with respect to movement of the isotope down the intestine during the first half-hour following injection of the isotope. As with the other two diets, the majority of the isotope in the intestine was found in the second and third, and in some cases, fourth, segment of the small intestine.

Two hr after isotope administration both the restrained and non-restrained animals on a low-fat diet showed that a considerable percentage of the isotope was regularly located not only in the fourth segment of the small intestine, but also in the cecum of the animal. This is in contrast to the animals on the other two diets; seldom were significant percentages of the isotope seen in this segment that early in any of the animals on either a normal or high-fat content diet. Furthermore, it was not unusual to detect significant quantities of the isotope in the first segment of the large intestine at this time in restrained low-fat animals. Beyond this time, however, no appreciable difference was noted between the passage times of restrained and non-restrained animals on the low-fat content diet or between animals on this diet and those on other diet regimens.

The passage of intestinal contents of animals exposed to either 50 R/day or 300 R/day ^{60}Co irradiation was not obviously different than that of sham-irradiated animals (Table X). A comparison of restrained with non-restrained

animals at each radiation dosage level, of restrained animals with each other at all dosage levels, or of non-restrained animals with each other at all dosage levels failed to show any consistent differences that could be attributed either to experimental treatment or to duration of restraint or non-restraint and concomitant exposure or to time of sacrifice after isotope administration.

Coliform Counts

The results of the bacterial counts on the intestinal flora are shown in Table XI. In all cases, as expected, the coliform counts contained in the jejunal segment were less than counts observed in the ileal segment. Except for one of four animals, the jejunal counts in all of high-fat content animals, both restrained and non-restrained, was considerably less than in those animals which were on a normal diet. There was no difference between the ileal counts of animals on a high-fat content diet and those on a stock diet. Neither was there any difference between the ileal coliform counts of restrained and non-restrained animals regardless of the fat content in the diet.

Behavioral Tests

Additionally, there were no behavioral differences noted between the behavior of the restrained rats and the behavior of the non-restrained rats when the animals were on (1) a normal diet, (2) a low-fat content diet, or (3) when they were exposed to radiation. It was, however, obvious that restraint did affect the behavior of animals placed on a high-fat content diet, but not that of non-restrained rats. Restrained animals became

extremely aggressive during the first 5 to 6 days they were on restraint, after which time they become somewhat more docile, reverting to near normal behavior. This finding was extremely consistent, leading us to test the response of a number of animals by subjecting them to an audiogenic stress. Previous work in this laboratory has indicated that this is a useful parameter for measuring neurological stress.[8] Animals on either a normal diet or high-fat content diet were subjected to restraint or to non-restraint conditions for a period of either 6 or 9 days. At the end of this time period, each animal was subjected to an audiogenic stress for a period of 2 min. This stress consisted of placing each animal into a 1 cubic foot black box containing a fire alarm bell which, when activated, produced a minimum sound level of 125 decibels inside the box. None of the animals so tested, regardless of restraint or diet, exhibited a reaction to the audiogenic stress.

Discussion

The results of these experiments indicate that restrained animals, regardless of whether they are on a normal diet, a low-fat content diet, or a high-fat content diet, experience a retardation of growth in comparison to the respective non-restrained animals. Although animals on a low-fat content diet did not gain weight as rapidly as did the respective animals on a normal diet, the retardation in growth between restrained and non-restrained animals in each diet was approximately equivalent. Animals given a high-fat content diet exhibited a much wider divergence of growth-rate between restrained and non-restrained than those maintained on the low-fat or stock diets.

Although caution must be exercised in attributing differences between or among either restrained or non-restrained rats on the different diets solely to fat content, several observations can be made. The non-restrained high-fat animals gained weight as rapidly as did the non-restrained animals on a regular diet. However, the restrained animals on a high-fat content diet not only did not gain weight but more generally lost weight; this was the only group to do so. Although it is tempting to speculate on the importance of such an observation, it should be pointed out that the container of food was placed in a different position than that used in the other groups because of the food consistency. Although this may account for some difference in eating habits, these animals did not eat less (in either quantity or frequency) than the other groups of animals.

There was no difference between the growth rate of the non-restrained sham-irradiated animals and that of the non-restrained animals which received 50 R/day. Neither was there a difference in growth-rate between restrained sham-irradiated and the restrained irradiated (50 R/day) animals. In both the sham-irradiated animals and 50 R/day animals the growth-rate of the restrained animals was somewhat less than was the growth-rate of the non-restrained animals. As the daily radiation dose was increased, however, the difference between the weights of non-restrained animals and the restrained animals decreased such that at 300 R/day there was essentially no difference between the non-restrained and the restrained animals in the growth-rate or weight loss. Thus, the higher

dose of radiation appeared to overcome any difference in weight which might have been due to the effect of restraint. That portion of the data which can be compared to the results obtained by Pfeiffer[1] or Sullivan[2] (the daily weights of restrained and non-restrained animals on normal diet) indicate that our results are comparable to those previously obtained.

The total radioactivity retained in the gastrointestinal tract did not appear to be increased or decreased by restraint. This was generally true regardless of the diet or the radiation dose or to the length of restraint and/or irradiation or to the postinjection time period.

It is interesting to note that animals on either a low-fat content diet or a high-fat content diet seemed to experience some degree of gastric retention when compared to animals on a normal diet. Gastric retention observed in the altered diets was generally more prevalent in the non-restrained animals than it was in the restrained animals. This is no doubt responsible for the observation that among the animals on the high-fat content diet the stomach contents of the restrained animals usually traversed the intestine slightly faster than did the contents in the non-restrained animals. This observation was often noted also among the animals on a low-fat diet.

It should be pointed out, furthermore, that among the animals on a low-fat diet, almost without exception, the restrained animals indicated that a significant percentage of the injected isotope, and hence of the stomach contents, had traversed the intestine to the cecum and/or the first segment of the large intestine within 2 hr after administration of the isotope.

Radioactivity was usually present in the cecum of non-restrained animals at that time also. The isotope had usually not traversed the length of the intestine and the cecum in either the restrained or the non-restrained animals that were fed either a normal diet or on a high-fat content diet within that time.

It is interesting to speculate about the weight increase of restrained animals on the high-fat content diet. From their unusual and aggressive behavior, which was not unlike previous observations with hypertensive rats, it is possible that the metabolic rate in these animals was increased to the point where, although they were eating a normal quantity of food (except for the first day of restraint), they were just as rapidly or even more rapidly dissipating the benefits thereof. The passage of the gut contents down the length of the gut in these animals, although perhaps slightly more rapid in some cases than in the non-restrained high-fat content animals, does not appear to justify any thoughts that the ingested food was being excreted any more rapidly than would normally be the case. Analysis of exhaled air for CO_2 content might give some indication as to whether or not these animals had a normal or an increased metabolic rate.

Previously published studies have shown that rats do experience a gastric retention after low doses (50 R) of radiation. Gastric retention was not measured, however, in these irradiated and sham-irradiated animals because of our method of isotope injection.

Although it has been shown[9] that upon exposure to 200 to 600 R of acute radiation there is an almost instantaneous increase in tone and motility in

rat small intestine, the increase in activity rapidly returns to normal. If this increase in the intestinal motility was present in the irradiated animals in these experiments, it did not manifest itself by a consequent increased rate of passage of the intestinal contents. The present data suggests that exposure to continuous ^{60}Co irradiation does not substantially alter the movement of the isotope through the intestinal tract in either restrained or non-restrained animals. Similarly there was no observable or consistent difference between the passage of gastrointestinal contents in restrained or non-restrained animals whether they were sham-irradiated, exposed to 50 R/day or exposed to 300 R/day. It should also be pointed out that with intraduodenal injection some of the isotope occasionally entered the stomach. This amount was, however, usually less than 10% of the injected dose. It may be fortuitous that almost all of the animals in which more than 10% of the injected isotope entered the stomach were animals which had been exposed to 300 R/day of continuous irradiation for a period of at least 3 days prior to injection of the isotope.

Although every attempt was made to keep the injected dose of isotope for any single group of animals constant, it was quite possible that minor variations in isotope quantity occurred. Since the specific activity of the isotope was extremely high in order to minimize the volume injected, small volume differences in the volume administered could account for substantial variations in retention.

The gross autoradiographs prepared in these studies showed no difference between restrained and non-restrained animals in either the concentration

or the location of the isotope with respect to various times of sacrifice, periods of restraint and diet comparisons and/or exposure rates. This was born out by the comparatively small differences observed in the counting rates of the various gastrointestinal segments.

Conclusions

It can be concluded from these experiments that:

(1) Restraint depresses growth rate when animals are on a normal diet.

(2) That animals on a low-fat content diet have a reduced growth-rate when compared to animals on a normal diet and that superimposing restraint upon this particular diet reduced the growth-rate even further.

(3) Non-restrained animals on a high-fat content diet have a normal growth-rate whereas restrained animals on a high-fat content diet have a low, or even negative, growth-rate.

(4) Sham-irradiated restrained animals have a slightly greater weight loss than do sham-irradiated non-restrained animals.

(5) Exposure to a continuous radiation dose of 50 R/day results in weights almost identical to the animals indicated in (4).

(6) Increasing that radiation dose to 300 R/day eliminates any weight difference that may occur between restrained and non-restrained animals such that both groups of animals lose weight more rapidly than any of the previously mentioned groups.

(7) There was little or no difference between the passage times of intestinal contents of restrained and non-restrained animals fed a stock diet.

(8) Both restrained and non-restrained animals on either a low-fat or high-fat content diet exhibited more gastric retention than animals on a stock diet and that within these groups the non-restrained animals seemed to exhibit this more often than did the restrained animals.

(9) Movement of the gastric contents through the intestinal tract in the restrained high-fat animals was usually a little faster than in the non-restrained animals.

(10) Passage time in the restrained animals on a low-fat content diet was slightly faster than that of the non-restrained animals on a low-fat content diet, both of which were considerably more rapid at 2 hr after isotope administration than were those animals on a stock or a high-fat diet.

(11) The restrained and the non-restrained animals which were either sham-irradiated or continuously exposed to 50 R/day or 300 R/day ^{60}Co irradiation showed little difference in the movement of the intestinal contents.

(12) Although the restrained animals on a high-fat content diet exhibited an aggressive behavior similar to a hypertensive state, neither they nor any of the other groups of animals so tested showed any response to a neurological stress such as an audiogenic insult.

(13) There was little change in bacterial count of the intestinal segments examined with respect to restraint or non-restraint, or length of time of restraint, or between the two diets tested.

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TABLE I

TIMES OF RESTRAINT AND SACRIFICE ACCORDING TO EXPERIMENTAL TREATMENT

	Days Restrained or Non-Restrained	Sacrifice Times After Isotope Administration (Hrs.)									
		0.5	1	2	4	6	8	9	12	14	24
Normal Diet	1	X		X		X				X	X
	2	X		X		X				X	X
	3	X	X	X	X	X		X	X		
	4	X		X		X				X	X
	5	X	X	X	X	X	X				
	6	X		X		X				X	X
	9	X		X		X				X	X
	13	X		X		X				X	X
	18	X		X		X				X	X
	24	X		X		X				X	X
	31	X		X		X				X	X
Low-Fat Content Diet	1	X	X	X	X	X	X				
	3	X	X	X	X	X	X				
	5	X	X	X	X	X	X				
	9	X		X		X					
	18	X		X		X					
	31	X		X		X					
High-Fat Content Diet	1	X		X	X						
	3	X		X		X					
	5	X	X	X	X	X	X				
	6	X		X		X					
	9	X		X		X					
	18	X		X		X					

TABLE I

(Continued)

	Days Restrained or Non-Restrained	Sacrifice Times after Isotope Administration (Hrs.)									
		0.5	1	2	4	6	8	9	12	14	24
Normal Diet (0 R/Day)	1	X	X	X	X	X	X				
	3	X	X	X	X	X	X				
	6	X	X	X	X	X	X				
	9	X	X	X	X	X	X				
Normal Diet (50 R/Day)	9	X	X	X	X						
Normal Diet (300 R/Day)	1	X	X	X	X		X				
	3	X	X	X	X	X	X				
	6	X	X	X	X	X	X				
	9	X	X	X	X	X	X				

TABLE II

WEIGHT DATA OF RESTRAINED AND NON-RESTRAINED RATS ON A NORMAL DIET

Days of Restraint	F Ratio	Body Weight as Percentage of Initial Weight			Difference Between Body Weight Percentages
		Non-Restrained Mean ± Std. Error	No. Animals[a]	Restrained Mean ± Std. Error	Non-Restrained minus Restrained Mean ± Std. Error
1	18.5*	100. ± 0.4	57[b]	98. ± 0.3	2.3 ± 0.5
2	18.8*	103. ± 0.5	53	100. ± 0.4	2.8 ± 0.7
3	17.2*	105. ± 0.7	41	101. ± 0.5	3.5 ± 0.9
4	23.5*	107. ± 0.9	36	101. ± 0.6	5.1 ± 1.0
5	29.9*	109. ± 0.6	30	104. ± 0.7	4.9 ± 0.9
6	22.8*	108. ± 0.7	25	103. ± 0.7	4.7 ± 1.0
7	16.7*	111. ± 0.9	25	105. ± 0.9	5.2 ± 1.3
8	11.8*	110. ± 1.0	25	106. ± 0.9	4.7 ± 1.4
9	10.6*	113. ± 1.2	20	107. ± 1.2	5.5 ± 1.7
10	11.2*	117. ± 1.2	20	111. ± 1.2	5.7 ± 1.7
11	13.3*	118. ± 1.2	20	112. ± 1.3	6.4 ± 1.7
12	11.4*	120. ± 1.5	20	114. ± 1.4	6.8 ± 2.0
13	16.5*	121. ± 1.4	15	113. ± 1.5	8.4 ± 2.1
14	7.8*	124. ± 2.0	15	117. ± 1.5	7.1 ± 2.5
15	11.8*	124. ± 1.8	15	117. ± 1.5	7.9 ± 2.3

* $P < 0.05$

[a] Number of rats in each non-restrained and restrained group.

[b] 58 rats were in the restrained group.

TABLE II

(Continued)

Days of Restraint	F Ratio	Body Weight as Percentage of Initial Weight			Difference Between Body Weight Percentages
		Non-Restrained Mean ± Std. Error	No. Animals	Restrained Mean ± Std. Error	Non-Restrained minus Restrained Mean ± Std. Error
16	11.3*	126. ± 1.8	15	118. ± 1.5	8.0 ± 2.4
17	11.2*	129. ± 2.2	15	120. ± 1.6	8.9 ± 2.7
18	5.5*	131. ± 2.9	10	122. ± 2.3	8.6 ± 3.7
19	5.8*	132. ± 2.9	10	123. ± 2.3	9.0 ± 3.7
20	6.8*	133. ± 3.0	10	123. ± 2.2	9.8 ± 3.8
21	4.5*	135. ± 3.8	10	125. ± 2.2	9.3 ± 4.4
22	5.8*	134. ± 3.5	10	124. ± 2.1	9.7 ± 4.1
23	4.9*	136. ± 3.0	10	127. ± 2.2	8.2 ± 3.7
24	2.1	136. ± 5.3	5	127. ± 2.8	8.7 ± 6.0
25	1.0	134. ± 7.3	5	127. ± 2.2	7.6 ± 7.7
26	1.8	136. ± 8.2	5	124. ± 3.0	11.8 ± 8.8
27	2.3	136. ± 5.5	5	127. ± 2.2	8.9 ± 5.9
28	3.1	137. ± 5.4	5	126. ± 3.3	11.1 ± 6.3
29	1.7	139. ± 6.7	5	129. ± 3.1	9.5 ± 7.4
30	2.0	142. ± 6.3	5	132. ± 3.4	10.0 ± 7.2

TABLE III

WEIGHT DATA OF RESTRAINED AND NON-RESTRAINED RATS ON A LOW-FAT CONTENT DIET

Days of Restraint	F Ratio	Body Weight as Percentage of Initial Weight			Difference Between Body Weight Percentages
		Non-Restrained Mean ± Std. Error	No. Animals	Restrained Mean ± Std. Error	Non-Restrained minus Restrained Mean ± Std. Error
1	4.4*	98. ± 0.5	21	97. ± 0.5	1.4 ± 0.7
2	6.4*	99. ± 0.6	21	97. ± 0.5	1.9 ± 0.8
3	15.6*	100. ± 0.7	15	96. ± 0.6	3.7 ± 0.9
4	10.7*	99. ± 0.9	15	95. ± 0.8	4.0 ± 1.2
5	11.2*	99. ± 0.8	9	96. ± 0.9	3.8 ± 1.1
6	4.2	100. ± 1.4	9	96. ± 1.5	4.1 ± 2.0
7	11.4*	103. ± 1.0	9	98. ± 0.9	4.7 ± 1.4
8	16.2*	104. ± 1.4	9	97. ± 1.1	7.1 ± 1.8
9	4.6	102. ± 1.9	6	97. ± 1.1	4.7 ± 2.2
10	7.1*	104. ± 1.5	6	99. ± 1.4	5.5 ± 2.1
11	3.9	102. ± 1.9	6	98. ± 1.5	4.7 ± 2.4
12	10.1*	106. ± 1.5	6	100. ± 1.0	5.6 ± 1.8
13	8.5*	109. ± 1.5	6	104. ± 0.9	5.2 ± 1.8
14	11.1*	109. ± 1.8	6	102. ± 0.9	6.6 ± 2.0
15	5.6*	109. ± 1.9	6	102. ± 1.8	6.1 ± 2.6

* $P \leq 0.05$

TABLE III

(Continued)

Days of Restraint	F Ratio	Body Weight as Percentage of Initial Weight			Difference Between Body Weight Percentages
		Non-Restrained Mean ± Std. Error	No. Animals	Restrained Mean ± Std. Error	Non-Restrained minus Restrained Mean ± Std. Error
16	5.8*	109. ± 2.2	6	103. ± 1.2	6.0 ± 2.5
17	6.4	113. ± 2.7	3	104. ± 2.5	9.2 ± 3.6
18	11.4*	113. ± 2.2	3	102. ± 2.2	10.7 ± 3.2
19	10.9*	115. ± 4.1	3	100. ± 2.0	14.9 ± 4.5
20	16.8*	112. ± 2.9	3	98. ± 2.1	14.7 ± 3.6
21	14.1*	117. ± 2.9	3	104. ± 1.2	13.1 ± 3.5
22	11.4*	117. ± 2.9	3	105. ± 1.9	11.9 ± 3.5
23	15.8*	119. ± 3.0	3	105. ± 1.7	13.5 ± 3.4
24	7.5	119. ± 3.8	3	107. ± 2.0	11.7 ± 4.3
25	11.6*	121. ± 3.4	3	107. ± 2.2	13.7 ± 4.0
26	9.7*	123. ± 3.3	3	111. ± 2.1	12.4 ± 4.0
27	10.5*	124. ± 3.1	3	112. ± 1.8	11.7 ± 3.6
28	6.9	125. ± 3.8	3	114. ± 2.2	11.5 ± 4.4
29	8.3*	126. ± 3.5	3	114. ± 1.9	11.5 ± 4.1
30	8.3*	127. ± 3.3	3	116. ± 2.1	11.2 ± 3.9

TABLE IV

WEIGHT DATA OF RESTRAINED AND NON-RESTRAINED RATS ON A HIGH-FAT CONTENT DIET

Days of Restraint	F Ratio	Body Weight as Percentage of Initial Weight			Difference Between Body Weight Percentages
		Non-Restrained Mean ± Std. Error	No. Animals	Restrained Mean ± Std. Error	Non-Restrained minus Restrained Mean ± Std. Error
1	110.0*	100. ± 0.5	18	93. ± 0.4	6.9 ± 0.7
2	130.4*	102. ± 0.6	18	92. ± 0.6	10.0 ± 0.9
3	122.6*	104. ± 0.8	15	90. ± 1.0	14.5 ± 1.3
4	105.3*	107. ± 1.1	15	90. ± 1.2	16.8 ± 1.6
5	104.5*	108. ± 1.1	9	88. ± 1.6	19.6 ± 1.9
6	59.4*	109. ± 1.5	6	89. ± 2.2	20.1 ± 2.6
7	60.2*	110. ± 1.8	6	88. ± 2.2	21.9 ± 2.8
8	59.5*	112. ± 2.0	6	88. ± 2.4	24.0 ± 3.1
9	70.6*	117. ± 2.2	3	90. ± 2.3	26.9 ± 3.2
10	94.2*	120. ± 2.1	3	91. ± 2.1	29.1 ± 3.0
11	84.5*	122. ± 2.8	3	89. ± 2.3	33.0 ± 3.6
12	89.8*	123. ± 2.9	3	89. ± 2.3	34.5 ± 3.6
13	75.9*	125. ± 2.8	3	89. ± 3.0	35.9 ± 4.1
14	76.0*	126. ± 2.9	3	88. ± 3.2	37.4 ± 4.3
15	79.9*	127. ± 2.9	3	88. ± 3.3	39.3 ± 4.4
16	68.2*	128. ± 3.6	3	88. ± 3.2	40.0 ± 4.9
17	63.5*	130. ± 3.5	3	89. ± 3.6	40.3 ± 5.1

* $P \leq 0.05$

TABLE V

WEIGHT DATA OF RESTRAINED AND NON-RESTRAINED RATS EXPOSED TO CONTINUOUS ^{60}Co IRRADIATION OR SHAM IRRADIATION

	Days of Restraint	F Ratio	Body Weight as Percentage of Initial Weight			Difference Between Body Weight Percentages
			Non-Restrained Mean ± Std. Error	No. Animals	Restrained Mean ± Std. Error	Non-Restrained minus Restrained Mean ± Std. Error
Sham	1	5.3*	98. ± 0.7	24	96. ± 0.7	2.3 ± 1.0
	2	20.8*	98. ± 0.4	18	95. ± 0.6	3.2 ± 0.7
	3	21.2*	98. ± 0.5	18	94. ± 0.7	4.1 ± 0.9
	4	26.0*	97. ± 0.4	12	92. ± 0.9	4.9 ± 1.0
	5	15.9*	97. ± 0.8	12	92. ± 1.1	5.3 ± 1.3
	6	12.5*	97. ± 0.8	12	92. ± 1.3	5.4 ± 1.5
	7	5.5*	97. ± 1.5	6	90. ± 2.5	6.9 ± 3.0
	8	5.0*	97. ± 1.5	6	91. ± 2.4	6.4 ± 2.9
	9	8.3*	98. ± 1.4	6	90. ± 2.2	7.5 ± 2.6
50 R/Day	1	0.2	99. ± 0.7	8	98. ± 1.6	0.7 ± 1.7
	2	1.4	100. ± 0.7	8	98. ± 1.6	2.1 ± 1.8
	3	6.5*	99. ± 0.7	8	95. ± 1.4	3.9 ± 1.5
	4	7.6*	98. ± 0.8	8	94. ± 1.4	4.3 ± 1.6
	5	6.5*	98. ± 0.9	8	93. ± 1.9	5.3 ± 2.1

TABLE V

(Continued)

	Days of Restraint	F Ratio	Body Weight as Percentage of Initial Weight: Non-Restrained Mean ± Std. Error	No. Animals	Body Weight as Percentage of Initial Weight: Restrained Mean ± Std. Error	Difference Between Body Weight Percentages: Non-Restrained minus Restrained Mean ± Std. Error
	6	8.9*	98. ± 1.0	8	91. ± 2.1	6.9 ± 2.3
	7	15.6*	98. ± 1.1	8	90. ± 1.8	8.4 ± 2.1
	8	15.2*	97. ± 1.3	8	88. ± 2.0	9.1 ± 1.5
	9	11.2*	94. ± 1.4	8	86. ± 2.0	8.2 ± 2.4
300 R/Day	1	1.3	96. ± 0.5	34	95. ± 0.7	1.0 ± 0.9
	2	1.5	94. ± 0.7	29	93. ± 0.8	1.2 ± 1.0
	3	1.9	91. ± 0.7	29	90. ± 0.7	1.3 ± 0.9
	4	1.7	89. ± 0.7	23	88. ± 0.7	1.3 ± 1.0
	5	2.9	86. ± 0.7	23	84. ± 0.7	1.7 ± 1.0
	6	4.5	83. ± 0.7	23	81. ± 0.7	2.0 ± 1.0
	7	2.3	81. ± 1.2	11	78. ± 1.0	2.3 ± 1.6
	8	2.5	77. ± 1.4	11	75. ± 1.1	2.8 ± 1.8
	9	2.4	75. ± 1.5	11	72. ± 1.2	2.9 ± 1.9

* $P \leq 0.05$

TABLE VII

TOTAL PERCENTAGE OF ISOTOPE REMAINING IN RESTRAINED AND NON-RESTRAINED RATS ON VARIOUS DIETS AFTER VARYING PERIODS OF RESTRAINT AND ISOTOPE ADMINISTRATION

Day	Hours Post-Adm.	Normal Diet		Low-Fat Diet		High-Fat Diet	
		Rest.	Non-Rest.	Rest.	Non-Rest.	Rest.	Non-Rest.
1	0.5	106	112	89	97	99	104
	1			87	112	85	108
	2	113	98	111	99		
	4			97	106	96	90
	6	104	106	107	95		
	8			80	88		
	14	85	48				
	24	16	25				
2	0.5	115	91				
	2	54	105				
	6	107	107				
	14	76	67				
	24	27	ND				
3	0.5	109	112	105	98	96	93
	1	106	107	93	55		
	2	99	97	94	99	100	105
	4	106	100	94	100		
	6	103	91	100	109	92	99
	8			44	67		
	9	102	93				
	12	70	39				
	14	32	41				
	24	11	28				

ND = No Data

TABLE VII

(Continued)

Day	Hours Post-Adm.	Normal Diet		Low-Fat Diet		High-Fat Diet	
		Rest.	Non-Rest.	Rest.	Non-Rest.	Rest.	Non-Rest.
4	0.5	108	101				
	2	107	107				
	6	99	102				
	14	52	59				
	24	7	39				
5	0.5	75	105	103	121	105	104
	1	107	105	97	102	90	107
	2	102	103	109	104	110	92
	4	103	102	112	99	112	98
	6	107	112	105	103	78	106
	8	91	89	30	45	97	92
6	0.5	105	109			106	106
	2	101	107			56	103
	6	93	103			100	97
	14	59	78				
	24	44	31				
9	0.5	108	113	104	100	113	85
	2	93	118	96	103	101	107
	6	102	102	74	85	101	99
	14	57	54				
	24	12	24				

TABLE VII

(Continued)

Day	Hours Post-Adm.	Normal Diet		Low-Fat Diet		High-Fat Diet	
		Rest.	Non-Rest.	Rest.	Non-Rest.	Rest.	Non-Rest.
13	0.5	116	100				
	2	100	113				
	6	103	108				
	14	63	69				
	24	27	21				
18	0.5	103	94	113	100	101	94
	2	102	96	59	116	95	100
	6	98	104	94	74	88	95
	14	58	66				
	24	13	13				
24	0.5	107	109				
	2	110	91				
	6	104	111				
	14	45	65				
	24	16	32				
31	0.5	109	107	103	98		
	2	104	104	82	102		
	6	128	106	87	69		
	14	44	53				
	24	10	26				

TABLE VIII

TOTAL PERCENTAGE OF ISOTOPE REMAININC IN RESTRAINED AND NON-RESTRAINED RATS AFTER VARYING PERIODS OF CONTINUOUS ^{60}Co IRRADIATION OR SHAM-IRRADIATION

Day	Hours Post-Adm.	0 R/Day		50 R/Day		300 R/Day	
		Rest.	Non-Rest.	Rest.	Non-Rest.	Rest.	Non-Rest.
1	0.5	74	89			94	100
	1	86	94			89	86
	2	81	92			91	93
	4	86	90			89	97
	6	96	92				
	8	96	93			91	90
3	0.5	86	86			91	97
	1	77	86			94	97
	2	84	85			98	92
	4	80	92			103	98
	6	84	105			102	85
	8	84	93			91	88
6	0.5	87	88			90	89
	1	84	80			91	90
	2	83	85			99	87
	4	75	83			79	83
	6	92	86			96	86
	8	93	69			87	89
9	0.5	86	72	90	82	89	94
	1	85	77	84	87	100	100
	2	86	82	90	85	103	100
	4	72	84	84	95	98	101
	6	82	85			78	95
	8	91	94			93	90

TABLE IX

DISTRIBUTION IN THE GASTROINTESTINAL TRACT (AS % OF DOSE ADMINISTERED) OF RATS ON EACH DIET AT TIME INTERVALS POST ISOTOPE ADMINISTRATION AFTER VARYING PERIODS OF RESTRAINT OR NON-RESTPAINT

Days Rest.	Hours Post-Admin.	Tissue Segment	Normal Diet		Low-Fat Diet		High-Fat Diet	
			Rest.	Non-Rest.	Rest.	Non-Rest.	Rest.	Non-Rest.
1	0.5	St.	39	40	10	41	32	86
		S.I.-1	36	14	14	8	9	6
		S.I.-2	32	37	16	5	14	7
		S.I.-3	--	22	48	25	35	6
		S.I.-4	--	--	2	19	9	--
		Ce.	--	--	--	--	--	--
		L.I.-1	--	--	--	--	--	--
		L.I.-2	--	--	--	--	--	--
1	1	St.			10	65		
		S.I.-1			5	7		
		S.I.-2			5	2		
		S.I.-3			65	10		
		S.I.-4			2	28		
		Ce.			--	--		
		L.I.-1			--	--		
		L.I.-2			--	--		
1	2	St.	49	2	7	38	23	65
		S.I.-1	3	4	7	4	3	5
		S.I.-2	7	3	4	2	3	2
		S.I.-3	50	19	6	1	4	4
		S.I.-4	5	70	50	52	52	27
		Ce.	--	--	30	1	--	5
		L.I.-1	--	--	7	--	--	--
		L.I.-2	--	--	--	--	--	--
1	4	St.			7	19	5	21
		S.I.-1			4	4	5	4
		S.I.-2			2	2	2	2
		S.I.-3			1	2	--	4
		S.I.-4			1	4	19	59
		Ce.			76	57	66	--
		L.I.-1			6	19	--	--
		L.I.-2			--	--	--	--

TABLE IX

(Continued)

Days Rest.	Hours Post-Admin.	Tissue Segment	Normal Diet		Low-Fat Diet		High-Fat Diet	
			Rest.	Non-Rest.	Rest.	Non-Rest.	Rest.	Non-Rest.
1	6	St.	1	--	6	20		
		S.I.-1	2	1	4	2		
		S.I.-2	1	--	3	2		
		S.I.-3	1	2	1	1		
		S.I.-4	1	4	2	3		
		Ce.	71	70	38	53		
		L.I.-1	11	29	18	9		
		L.I.-2	17	--	36	5		
1	8	St.			3	11		
		S.I.-1			4	2		
		S.I.-2			2	3		
		S.I.-3			1	1		
		S.I.-4			1	4		
		Ce.			45	49		
		L.I.-1			11	9		
		L.I.-2			12	8		
1	14	St.	--	--				
		S.I.-1	1	1				
		S.I.-2	--	5				
		S.I.-3	--	--				
		S.I.-4	--	--				
		Ce.	77	34				
		L.I.-1	6	4				
		L.I.-2	--	4				
1	24	St.	--	--				
		S.I.-1	--	1				
		S.I.-2	--	--				
		S.I.-3	--	--				
		S.I.-4	--	--				
		Ce.	11	24				
		L.I.-1	2	--				
		L.I.-2	3	--				

TABLE IX

(Continued)

Days Rest.	Hours Post-Admin.	Tissue Segment	Normal Diet		Low-Fat Diet		High-Fat Diet	
			Rest.	Non-Rest.	Rest.	Non-Rest.	Rest.	Non-Rest.
2	0.5	St.	58	69				
		S.I.-1	9	6				
		S.I.-2	37	16				
		S.I.-3	11	1				
		S.I.-4	--	--				
		Ce.	--	--				
		L.I.-1	--	--				
		L.I.-2	--	--				
2	2	St.	20	13				
		S.I.-1	4	3				
		S.I.-2	7	3				
		S.I.-3	12	21				
		S.I.-4	12	58				
		Ce.	--	6				
		L.I.-1	--	1				
		L.I.-2	--	--				
2	6	St.	4	12				
		S.I.-1	1	1				
		S.I.-2	1	4				
		S.I.-3	4	4				
		S.I.-4	22	17				
		Ce.	74	64				
		L.I.-1	1	6				
		L.I.-2	--	--				
2	14	St.	--	--				
		S.I.-1	1	--				
		S.I.-2	--	--				
		S.I.-3	--	--				
		S.I.-4	2	--				
		Ce.	64	53				
		L.I.-1	9	12				
		L.I.-2	--	1				

TABLE IX

(Continued)

Days Rest.	Hours Post-Admin.	Tissue Segment	Normal Diet		Low-Fat Diet		High-Fat Diet	
			Rest.	Non-Rest.	Rest.	Non-Rest.	Rest.	Non-Rest.
2	24	St.	--					
		S.I.-1	1					
		S.I.-2	--					
		S.I.-3	--					
		S.I.-4	--					
		Ce.	24					
		L.I.-1	2					
		L.I.-2	1					
3	0.5	St.	63	57	72	66	54	87
		S.I.-1	9	15	4	10	6	5
		S.I.-2	14	18	3	16	5	1
		S.I.-3	24	17	18	3	26	--
		S.I.-4	--	4	8	3	6	--
		Ce.	--	--	--	--	--	--
		L.I.-1	--	--	--	--	--	--
		L.I.-2	--	--	--	--	--	--
3	1	St.	28	64	35	38		
		S.I.-1	3	3	3	2		
		S.I.-2	4	7	5	1		
		S.I.-3	54	31	13	7		
		S.I.-4	18	3	37	9		
		Ce.	--	--	--	--		
		L.I.-1	--	--	--	--		
		L.I.-2	--	--	--	--		
3	2	St.	21	19	29	39	53	54
		S.I.-1	3	4	3	21	3	3
		S.I.-2	5	5	3	2	3	3
		S.I.-3	21	40	7	3	5	12
		S.I.-4	27	27	15	8	36	31
		Ce.	23	8	28	27	--	1
		L.I.-1	1	--	10	--	--	--
		L.I.-2	--	--	--	--	--	--

TABLE IX

(Continued)

Days Rest.	Hours Post-Admin.	Tissue Segment	Normal Diet		Low-Fat Diet		High-Fat Diet	
			Rest.	Non-Rest.	Rest.	Non-Rest.	Rest.	Non-Rest.
3	4	St.	24	22	35	65		
		S.I.-1	2	2	3	2		
		S.I.-2	7	3	2	1		
		S.I.-3	7	4	3	1		
		S.I.-4	11	5	4	3		
		Ce.	55	62	47	25		
		L.I.-1	--	3	--	3		
		L.I.-2	--	--	--	--		
3	6	St.	2	--	38	32	22	47
		S.I.-1	3	3	1	2	3	2
		S.I.-2	2	2	2	3	2	1
		S.I.-3	4	1	3	4	7	1
		S.I.-4	12	3	4	5	9	4
		Ce.	69	67	34	36	49	38
		L.I.-1	7	16	5	18	--	6
		L.I.-2	4	--	13	10	--	--
3	8	St.			4	20		
		S.I.-1			2	2		
		S.I.-2			3	4		
		S.I.-3			2	2		
		S.I.-4			1	5		
		Ce			26	25		
		L.I.-1			8	11		
		L.I.-2			--	--		
3	9	St.	5	5				
		S.I.-1	1	1				
		S.I.-2	2	2				
		S.I.-3	1	3				
		S.I.-4	1	9				
		Ce.	74	63				
		L.I.-1	8	7				
		L.I.-2	9	3				

TABLE IX

(Continued)

Days Rest.	Hours Post-Admin.	Tissue Segment	Normal Diet		Low-Fat Diet		High-Fat Diet	
			Rest.	Non-Rest.	Rest.	Non-Rest.	Rest.	Non-Rest.
3	12	St.	1	--				
		S.I.-1	2	1				
		S.I.-2	2	1				
		S.I.-3	1	1				
		S.I.-4	1	1				
		Ce.	50	22				
		L.I.-1	13	11				
		L.I.-2	1	2				
3	14	St.	--	--				
		S.I.-1	1	1				
		S.I.-2	1	--				
		S.I.-3	--	--				
		S.I.-4	--	1				
		Ce.	26	28				
		L.I.-1	5	7				
		L.I.-2	--	4				
3	24	St.	--	--				
		S.I.-1	--	--				
		S.I.-2	--	--				
		S.I.-3	--	--				
		S.I.-4	1	3				
		Ce.	10	13				
		L.I.-1	--	1				
		L.I.-2	--	11				
4	0.5	St.	60	80				
		S.I.-1	4	7				
		S.I.-2	13	10				
		S.I.-3	31	4				
		S.I.-4	--	--				
		Ce.	--	--				
		L.I.-1	--	--				
		L.I.-2	--	--				

TABLE IX

(Continued)

Days Rest.	Hours Post-Admin.	Tissue Segment	Normal Diet		Low-Fat Diet		High-Fat Diet	
			Rest.	Non-Rest.	Rest.	Non-Rest.	Rest.	Non-Rest.
4	2	St.	33	42				
		S.I.-1	6	5				
		S.I.-2	17	13				
		S.I.-3	51	39				
		S.I.-4	--	9				
		Ce.	--	--				
		L.I.-1	--	--				
		L.I.-2	--	--				
4	6	St.	--	3				
		S.I.-1	4	2				
		S.I.-2	1	2				
		S.I.-3	1	1				
		S.I.-4	1	8				
		Ce.	69	79				
		L.I.-1	6	8				
		L.I.-2	16	--				
4	14	St.	--	--				
		S.I.-1	1	2				
		S.I.-2	1	1				
		S.I.-3	--	--				
		S.I.-4	--	--				
		Ce	32	39				
		L.I.-1	9	9				
		L.I.-2	7	8				
4	24	St.	1	5				
		S.I.-1	1	1				
		S.I.-2	1	1				
		S.I.-3	1	1				
		S.I.-4	--	1				
		Ce.	4	22				
		L.I.-1	1	3				
		L.I.-2	1	7				

TABLE IX

(Continued)

Days Rest.	Hours Post-Admin.	Tissue Segment	Normal Diet		Low-Fat Diet		High-Fat Diet	
			Rest.	Non-Rest.	Rest.	Non-Rest.	Rest.	Non-Rest.
5	0.5	St.	39	57	57	89	35	19
		S.I.-1	5	5	6	7	17	16
		S.I.-2	21	10	8	5	18	19
		S.I.-3	11	33	29	20	35	51
		S.I.-4	--	1	4	--	1	--
		Ce.	--	--	--	--	--	--
		L.I.-1	--	--	--	--	--	--
		L.I.-2	--	--	--	--	--	--
5	1	St.	20	39	28	39	20	14
		S.I.-1	3	4	6	4	7	4
		S.I.-2	5	8	6	4	7	5
		S.I.-3	10	49	20	42	16	26
		S.I.-4	69	4	37	13	39	58
		Ce.	--	--	--	--	--	1
		L.I.-1	--	--	--	--	--	--
		L.I.-2	--	--	--	--	--	--
5	2	St.	51	28	31	29	22	1
		S.I.-1	3	3	6	4	5	5
		S.I.-2	9	6	7	4	4	5
		S.I.-3	35	22	7	4	5	11
		S.I.-4	4	44	22	56	64	70
		Ce.	--	--	26	7	10	1
		L.I.-1	--	--	10	1	--	--
		L.I.-2	--	--	--	--	--	--
5	4	St.	20	4	37	46	2	4
		S.I.-1	3	3	3	2	6	4
		S.I.-2	4	5	4	2	4	3
		S.I.-3	6	5	3	3	2	1
		S.I.-4	10	9	3	4	52	7
		Ce.	60	47	44	26	45	79
		L.I.-1	--	30	16	17	1	--
		L.I.-2	--	--	1	--	--	--

TABLE IX

(Continued)

Days Rest.	Hours Post-Admin.	Tissue Segment	Normal Diet		Low-Fat Diet		High-Fat Diet	
			Rest.	Non-Rest.	Rest.	Non-Rest.	Rest.	Non-Rest.
5	6	St.	3	11	14	25	2	8
		S.I.-1	3	3	3	4	4	3
		S.I.-2	4	4	4	4	3	2
		S.I.-3	4	7	4	5	2	1
		S.I.-4	4	9	5	9	4	4
		Ce.	74	56	35	54	64	73
		L.I.-1	13	15	19	1	--	15
		L.I.-2	3	8	21	2	--	2
5	8	St.	9	7	7	8	1	--
		S.I.-1	2	3	2	2	4	3
		S.I.-2	3	4	3	3	1	1
		S.I.-3	3	5	4	3	1	1
		S.I.-4	5	9	4	10	3	2
		Ce.	59	47	9	12	67	68
		L.I.-1	12	13	2	7	2	16
		L.I.-2	--	--	--	--	18	--
6	0.5	St.	70	44			61	92
		S.I.-1	5	20			10	4
		S.I.-2	11	35			6	6
		S.I.-3	20	10			26	5
		S.I.-4	--	--			2	--
		Ce.	--	--			--	--
		L.I.-1	--	--			--	--
		L.I.-2	--	--			--	--
6	2	St.	20	37			4	83
		S.I.-1	4	5			5	3
		S.I.-2	6	9			5	1
		S.I.-3	28	50			2	2
		S.I.-4	44	6			26	16
		Ce.	--	--			14	--
		L.I.-1	--	--			--	--
		L.I.-2	--	--			--	--

TABLE IX

(Continued)

Days Rest.	Hours Post-Admin.	Tissue Segment	Normal Diet		Low-Fat Diet		High-Fat Diet	
			Rest.	Non-Rest.	Rest.	Non-Rest.	Rest.	Non-Rest.
6	6	St.	--	18			15	35
		S.I.-1	2	1			4	3
		S.I.-2	3	3			3	--
		S.I.-3	4	9			3	2
		S.I.-4	6	14			6	10
		Ce.	65	51			31	46
		L.I.-1	14	8			39	--
		L.I.-2	--	--			--	1
6	14	St.	--	1				
		S.I.-1	1	1				
		S.I.-2	3	1				
		S.I.-3	--	1				
		S.I.-4	--	4				
		Ce.	41	48				
		L.I.-1	13	9				
		L.I.-2	1	13				
6	24	St.	4	--				
		S.I.-1	1	1				
		S.I.-2	3	--				
		S.I.-3	1	--				
		S.I.-4	4	--				
		Ce.	22	26				
		L.I.-1	3	2				
		L.I.-2	6	2				
9	0.5	St.	68	38	75	64	47	61
		S.I.-1	24	11	5	3	7	5
		S.I.-2	16	17	5	6	10	4
		S.I.-3	--	38	14	27	40	15
		S.I.-4	--	9	6	--	10	--
		Ce.	--	--	--	--	--	--
		L.I.-1	--	--	--	--	--	--
		L.I.-2	--	--	--	--	--	--

TABLE IX

(Continued)

Days Rest.	Hours Post-Admin.	Tissue Segment	Normal Diet		Low-Fat Diet		High-Fat Diet	
			Rest.	Non-Rest.	Rest.	Non-Rest.	Rest.	Non-Rest.
9	2	St.	15	36	51	60	7	43
		S.I.-1	4	3	1	2	7	5
		S.I.-2	5	6	1	2	4	4
		S.I.-3	69	14	3	4	8	7
		S.I.-4	--	20	8	13	75	48
		Ce.	--	35	13	22	--	1
		L.I.-1	--	5	18	--	--	--
		L.I.-2	--	--	--	--	--	--
9	6	St.	2	4	46	44	13	47
		S.I.-1	2	2	1	2	3	3
		S.I.-2	20	1	2	2	2	2
		S.I.-3	5	3	2	3	2	3
		S.I.-4	7	7	3	5	1	3
		Ce.	52	69	11	13	61	40
		L.I.-1	11	16	6	6	19	2
		L.I.-2	3	--	4	11	--	--
9	14	St.	--	--				
		S.I.-1	1	1				
		S.I.-2	--	--				
		S.I.-3	--	--				
		S.I.-4	--	--				
		Ce.	45	44				
		L.I.-1	8	7				
		L.I.-2	3	2				
9	24	St.	--	--				
		S.I.-1	1	--				
		S.I.-2	--	--				
		S.I.-3	--	--				
		S.I.-4	--	--				
		Ce.	10	17				
		L.I.-1	--	--				
		L.I.-2	--	6				

TABLE IX

(Continued)

Days Rest.	Hours Post-Admin.	Tissue Segment	Normal Diet		Low-Fat Diet		High-Fat Diet	
			Rest.	Non-Rest.	Rest.	Non-Rest.	Rest.	Non-Rest.
13	0.5	St.	45	77				
		S.I.-1	12	7				
		S.I.-2	52	15				
		S.I.-3	8	1				
		S.I.-4	--	--				
		Ce.	--	--				
		L.I.-1	--	--				
		L.I.-2	--	--				
13	2	St.	17	16				
		S.I.-1	2	6				
		S.I.-2	4	6				
		S.I.-3	13	41				
		S.I.-4	64	44				
		Ce.	2	--				
		L.I.-1	--	--				
		L.I.-2	--	--				
13	6	St.	7	14				
		S.I.-1	2	1				
		S.I.-2	2	3				
		S.I.-3	3	4				
		S.I.-4	4	7				
		Ce.	85	67				
		L.I.-1	--	10				
		L.I.-2	--	2				
13	14	St.	--	--				
		S.I.-1	1	1				
		S.I.-2	1	--				
		S.I.-3	--	--				
		S.I.-4	--	1				
		Ce.	49	49				
		L.I.-1	8	10				
		L.I.-2	3	8				

TABLE IX

(Continued)

Days Rest.	Hours Post-Admin.	Tissue Segment	Normal Diet		Low-Fat Diet		High-Fat Diet	
			Rest.	Non-Rest.	Rest.	Non-Rest.	Rest.	Non-Rest.
13	24	St.	--	--				
		S.I.-1	1	--				
		S.I.-2	--	--				
		S.I.-3	--	--				
		S.I.-4	--	--				
		Ce.	21	13				
		L.I.-1	5	5				
		L.I.-2	--	2				
18	0.5	St.	47	41	64	47	66	53
		S.I.-1	17	19	5	6	4	5
		S.I.-2	3	32	6	9	5	6
		S.I.-3	37	2	24	37	23	29
		S.I.-4	--	--	14	1	4	1
		Ce.	--	--	--	--	--	--
		L.I.-1	--	--	--	--	--	--
		L.I.-2	--	--	--	--	--	--
18	2	St.	9	43	31	50	39	54
		S.I.-1	4	20	2	4	3	4
		S.I.-2	8	3	1	4	3	2
		S.I.-3	49	29	4	8	39	5
		S.I.-4	33	--	6	36	11	37
		Ce.	--	--	16	7	1	--
		L.I.-1	--	--	--	8	--	--
		L.I.-2	--	--	--	--	--	--
18	6	St.	1	--	17	41	--	33
		S.I.-1	3	2	2	2	4	3
		S.I.-2	1	1	2	2	1	3
		S.I.-3	2	6	3	3	1	5
		S.I.-4	5	11	8	2	4	4
		Ce.	86	69	20	18	57	33
		L.I.-1	1	14	15	6	20	13
		L.I.-2	--	--	28	--	--	--

TABLE IX

(Continued)

Days Rest.	Hours Post-Admin.	Tissue Segment	Normal Diet		Low-Fat Diet		High-Fat Diet	
			Rest.	Non-Rest.	Rest.	Non-Rest.	Rest.	Non-Rest.
18	14	St.	--	--				
		S.I.-1	1	1				
		S.I.-2	1	--				
		S.I.-3	--	--				
		S.I.-4	--	--				
		Ce.	47	49				
		L.I.-1	8	6				
		L.I.-2	1	10				
18	24	St.	--	--				
		S.I.-1	--	1				
		S.I.-2	--	--				
		S.I.-3	--	--				
		S.I.-4	--	--				
		Ce.	6	10				
		L.I.-1	2	1				
		L.I.-2	5	2				
24	0.5	St.	60	88				
		S.I.-1	23	18				
		S.I.-2	25	3				
		S.I.-3	--	1				
		S.I.-4	--	--				
		Ce.	--	--				
		L.I.-1	--	--				
		L.I.-2	--	--				
24	2	St.	12	16				
		S.I.-1	4	4				
		S.I.-2	5	15				
		S.I.-3	57	36				
		S.I.-4	31	21				
		Ce.	--	--				
		L.I.-1	--	--				
		L.I.-2	--	--				

TABLE IX

(Continued)

Days Rest.	Hours Post-Admin.	Tissue Segment	Normal Diet		Low-Fat Diet		High-Fat Diet	
			Rest.	Non-Rest.	Rest.	Non-Rest.	Rest.	Non-Rest.
24	6	St.	1	8				
		S.I.-1	2	2				
		S.I.-2	1	8				
		S.I.-3	2	7				
		S.I.-4	13	23				
		Ce.	70	54				
		L.I.-1	16	10				
		L.I.-2	--	--				
24	14	St.	--	--				
		S.I.-1	1	--				
		S.I.-2	--	--				
		S.I.-3	--	--				
		S.I.-4	--	--				
		Ce.	37	33				
		L.I.-1	6	9				
		L.I.-2	--	22				
24	24	St.	4	--				
		S.I.-1	--	1				
		S.I.-2	1	--				
		S.I.-3	1	--				
		S.I.-4	--	--				
		Ce.	8	15				
		L.I.-1	2	8				
		L.I.-2	1	8				
31	0.5	St.	67	64	76	63		
		S.I.-1	8	9	4	1		
		S.I.-2	31	22	4	19		
		S.I.-3	4	12	16	11		
		S.I.-4	--	--	4	5		
		Ce.	--	--	--	--		
		L.I.-1	--	--	--	--		
		L.I.-2	--	--	--	--		

TABLE IX

(Continued)

Days Rest.	Hours Post-Admin.	Tissue Segment	Normal Diet		Low-Fat Diet		High-Fat Diet	
			Rest.	Non-Rest.	Rest.	Non-Rest.	Rest.	Non-Rest.
31	2	St.	6	17	32	26		
		S.I.-1	4	5	2	2		
		S.I.-2	5	7	2	3		
		S.I.-3	49	70	3	5		
		S.I.-4	40	6	39	37		
		Ce.	--	--	4	29		
		L.I.-1	--	--	--	--		
		L.I.-2	--	--	--	--		
31	6	St.	--	7	44	26		
		S.I.-1	32	3	2	2		
		S.I.-2	1	2	2	2		
		S.I.-3	1	2	4	2		
		S.I.-4	2	4	7	5		
		Ce.	68	55	12	8		
		L.I.-1	23	20	13	23		
		L.I.-2	--	14	4	2		
31	14	St.	--	--				
		S.I.-1	1	1				
		S.I.-2	1	--				
		S.I.-3	--	--				
		S.I.-4	--	--				
		Ce.	34	40				
		L.I.-1	5	8				
		L.I.-2	2	6				
31	24	St.	--	--				
		S.I.-1	--	--				
		S.I.-2	--	--				
		S.I.-3	--	--				
		S.I.-4	--	--				
		Ce.	8	22				
		L.I.-1	1	3				
		L.I.-2	--	2				

TABLE X

DISTRIBUTION IN THE GASTROINTESTINAL TRACT (AS % OF DOSE ADMINISTERED AT TIME INTERVALS AFTER ISOTOPE ADMINISTRATION) IN RATS SUBJECTED TO VARYING PERIODS OF ^{60}Co IRRADIATION OR SHAM-IRRADIATION AND RESTRAINT OR NON-RESTRAINT

Days Rest.	Hours Post-Admin.	Tissue Segment	0 R/Day		50 R/Day		300 R/Day	
			Rest.	Non-Rest.	Rest.	Non-Rest.	Rest.	Non-Rest.
1	0.5	St.	1	1			7	1
		S.I.-1	47	42			33	24
		S.I.-2	24	43			54	69
		S.I.-3	2	3			--	6
		S.I.-4	--	--			--	--
		Ce.	--	--			--	--
		L.I.-1	--	--			--	--
		L.I.-2	--	--			--	--
1	1	St.	3	11			3	3
		S.I.-1	10	12			26	19
		S.I.-2	22	56			60	54
		S.I.-3	51	17			--	11
		S.I.-4	1	--			--	--
		Ce.	--	--			--	--
		L.I.-1	--	--			--	--
		L.I.-2	--	--			--	--
1	2	St.	1	2			1	4
		S.I.-1	7	9			5	7
		S.I.-2	4	7			22	23
		S.I.-3	69	66			61	59
		S.I.-4	--	9			1	--
		Ce.	--	--			--	--
		L.I.-1	--	--			--	--
		L.I.-2	--	--			--	--
1	4	St.	5	1			--	1
		S.I.-1	4	4			5	5
		S.I.-2	2	1			2	3
		S.I.-3	30	49			3	16
		S.I.-4	44	35			79	42
		Ce.	--	--			--	27
		L.I.-1	--	--			--	3
		L.I.-2	--	--			--	--
1	6	St.	--	3				
		S.I.-1	2	2				
		S.I.-2	1	1				
		S.I.-3	2	1				
		S.I.-4	10	44				
		Ce.	80	41				
		L.I.-1	--	--				
		L.I.-2	--	--				

TABLE X

(Continued)

Days Rest.	Hours Post-Admin.	Tissue Segment	0 R/Day		50 R/Day		300 R/Day	
			Rest.	Non-Rest.	Rest.	Non-Rest.	Rest.	Non-Rest.
1	8	St.	8	5			--	--
		S.I.-1	2	3			3	4
		S.I.-2	2	1			1	2
		S.I.-3	7	1			1	14
		S.I.-4	55	2			72	70
		Ce.	22	66			15	--
		L.I.-1	--	1			--	--
		L.I.-2	--	15			--	--
3	0.5	St.	9	3			7	3
		S.I.-1	48	17			29	42
		S.I.-2	30	47			55	52
		S.I.-3	--	19			1	--
		S.I.-4	--	--			--	--
		Ce.	--	--			--	--
		L.I.-1	--	--			--	--
		L.I.-2	--	--			--	--
3	1	St.	2	1			7	3
		S.I.-1	36	9			13	15
		S.I.-2	39	40			34	13
		S.I.-3	--	37			41	40
		S.I.-4	--	--			--	26
		Ce.	--	--			--	--
		L.I.-1	--	--			--	--
		L.I.-2	--	--			--	--
3	2	St.	--	2			7	10
		S.I.-1	7	6			13	10
		S.I.-2	49	5			13	3
		S.I.-3	29	71			56	36
		S.I.-4	--	2			9	33
		Ce.	--	--			--	--
		L.I.-1	--	--			--	--
		L.I.-2	--	--			--	--
3	4	St.	--	--			14	6
		S.I.-1	5	5			5	10
		S.I.-2	1	2			2	3
		S.I.-3	61	53			21	27
		S.I.-4	14	32			51	33
		Ce.	--	--			11	19
		L.I.-1	--	--			--	--
		L.I.-2	--	--			--	--

TABLE X

(Continued)

Days Rest.	Hours Post-Admin.	Tissue Segment	0 R/Day		50 R/Day		300 R/Day	
			Rest.	Non-Rest.	Rest.	Non-Rest.	Rest.	Non-Rest.
3	6	St.	4	18			31	1
		S.I.-1	3	5			6	2
		S.I.-2	1	5			2	3
		S.I.-3	6	6			11	5
		S.I.-4	51	23			53	75
		Ce.	20	42			--	--
		L.I.-1	--	5			--	--
		L.I.-2	--	1			--	--
3	8	St.	--	1			2	1
		S.I.-1	2	3			2	2
		S.I.-2	1	--			1	1
		S.I.-3	36	1			4	1
		S.I.-4	45	14			8	67
		Ce.	--	58			71	15
		L.I.-1	--	17			5	1
		L.I.-2	--	--			--	--
6	0.5	St.	3	10			26	59
		S.I.-1	72	67			38	14
		S.I.-2	12	11			27	14
		S.I.-3	--	--			--	3
		S.I.-4	--	--			--	--
		Ce.	--	--			--	--
		L.I.-1	--	--			--	--
		L.I.-2	--	--			--	--
6	1	St.	4	2			32	1
		S.I.-1	20	41			24	21
		S.I.-2	54	36			23	23
		S.I.-3	5	--			13	41
		S.I.-4	--	--			--	5
		Ce.	--	--			--	--
		L.I.-1	--	--			--	--
		L.I.-2	--	--			--	--
6	2	St.	--	2			21	11
		S.I.-1	4	11			11	9
		S.I.-2	15	5			15	6
		S.I.-3	65	68			37	35
		S.I.-4	--	--			16	28
		Ce.	--	--			--	--
		L.I.-1	--	--			--	--
		L.I.-2	--	--			--	--

TABLE X

(Continued)

Days Rest.	Hours Post-Admin.	Tissue Segment	0 R/Day		50 R/Day		300 R/Day	
			Rest.	Non-Rest.	Rest.	Non-Rest.	Rest.	Non-Rest.
6	4	St.	--	--			2	7
		S.I.-1	2	3			7	5
		S.I.-2	--	1			5	7
		S.I.-3	6	1			38	24
		S.I.-4	66	72			28	41
		Ce.	--	5			--	--
		L.I.-1	--	1			--	--
		L.I.-2	--	--			--	--
6	6	St.	5	--			6	1
		S.I.-1	4	2			5	5
		S.I.-2	1	1			3	2
		S.I.-3	8	1			9	3
		S.I.-4	63	5			56	49
		Ce.	1	72			18	20
		L.I.-1	--	5			--	1
		L.I.-2	9	--			--	8
6	8	St.	--	--			2	1
		S.I.-1	3	2			3	3
		S.I.-2	--	--			2	2
		S.I.-3	2	--			5	1
		S.I.-4	10	1			53	6
		Ce.	60	45			22	72
		L.I.-1	18	8			--	1
		L.I.-2	--	13			--	4
9	0.5	St.	11	1	--	--	8	2
		S.I.-1	28	19	30	38	40	17
		S.I.-2	45	51	49	44	33	44
		S.I.-3	2	--	11	--	9	29
		S.I.-4	--	--	--	--	--	2
		Ce.	--	--	--	--	--	--
		L.I.-1	--	--	--	--	--	--
		L.I.-2	--	--	--	--	--	--
9	1	St.	1	2	2	--	7	3
		S.I.-1	19	16	14	9	29	22
		S.I.-2	37	42	68	65	11	28
		S.I.-3	28	16	--	13	36	35
		S.I.-4	1	--	--	--	18	14
		Ce.	--	1	--	--	--	--
		L.I.-1	--	--	--	--	--	--
		L.I.-2	--	--	--	--	--	--

TABLE X

(Continued)

Days Rest.	Hours Post-Admin.	Tissue Segment	0 R/Day		50 R/Day		300 R/Day	
			Rest.	Non-Rest.	Rest.	Non-Rest.	Rest.	Non-Rest.
9	2	St.	6	1	1	--	30	16
		S.I.-1	11	5	15	7	16	21
		S.I.-2	52	6	2	7	21	8
		S.I.-3	17	66	60	70	27	37
		S.I.-4	--	5	12	--	11	19
		Ce.	--	--	--	--	--	--
		L.I.-1	--	--	--	--	--	--
		L.I.-2	--	--	--	--	--	--
9	4	St.	1	6	2	--	15	8
		S.I.-1	4	10	16	6	19	7
		S.I.-2	3	7	18	3	10	32
		S.I.-3	64	5	47	58	22	28
		S.I.-4	--	57	--	28	32	25
		Ce.	--	--	--	--	--	--
		L.I.-1	--	--	--	--	--	--
		L.I.-2	--	--	--	--	--	--
9	6	St.	1	--			5	2
		S.I.-1	5	2			14	9
		S.I.-2	1	1			6	8
		S.I.-3	14	4			13	26
		S.I.-4	53	10			40	50
		Ce.	8	66			--	--
		L.I.-1	--	1			--	--
		L.I.-2	--	2			--	--
9	8	St.	5	1			--	3
		S.I.-1	1	2			3	2
		S.I.-2	--	--			2	3
		S.I.-3	1	1			2	23
		S.I.-4	1	3			11	42
		Ce.	54	46			33	14
		L.I.-1	4	39			31	2
		L.I.-2	25	2			12	1

TABLE XI

BACTERIAL COUNTS AFTER INDICATED DAYS OF RESTRAINT OR NON-RESTRAINT

	Days	Intestinal Segment	Restraint	Non-Restraint
Normal Diet	7	Jejunum	16600	20000
		Ileum	100800	380000
	21	Jejunum	24500	13700
		Ileum	289000	333000
High-Fat	21	Jejunum	20100[a]	454
		Ileum	1790000	260000

(a) One restrained rat had a high jejunal count; hence, the difference between restrained and non-restrained rats on this diet.

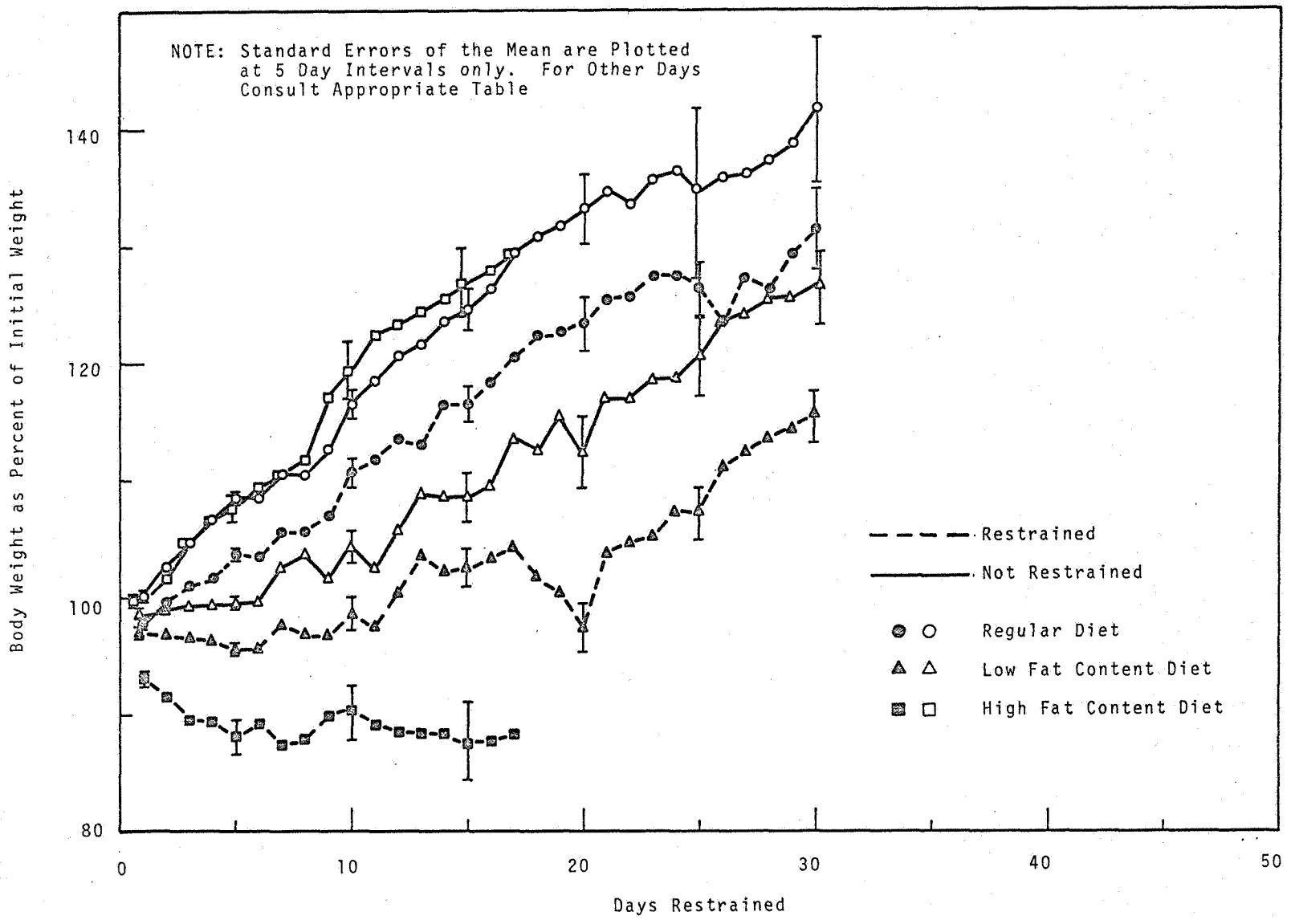

FIGURE 1
Body Weight Changes (as a Percentage of Initial Body Weight) of Restrained and Non-Restrained Rats on a Normal, Low-Fat or High Fat Diet

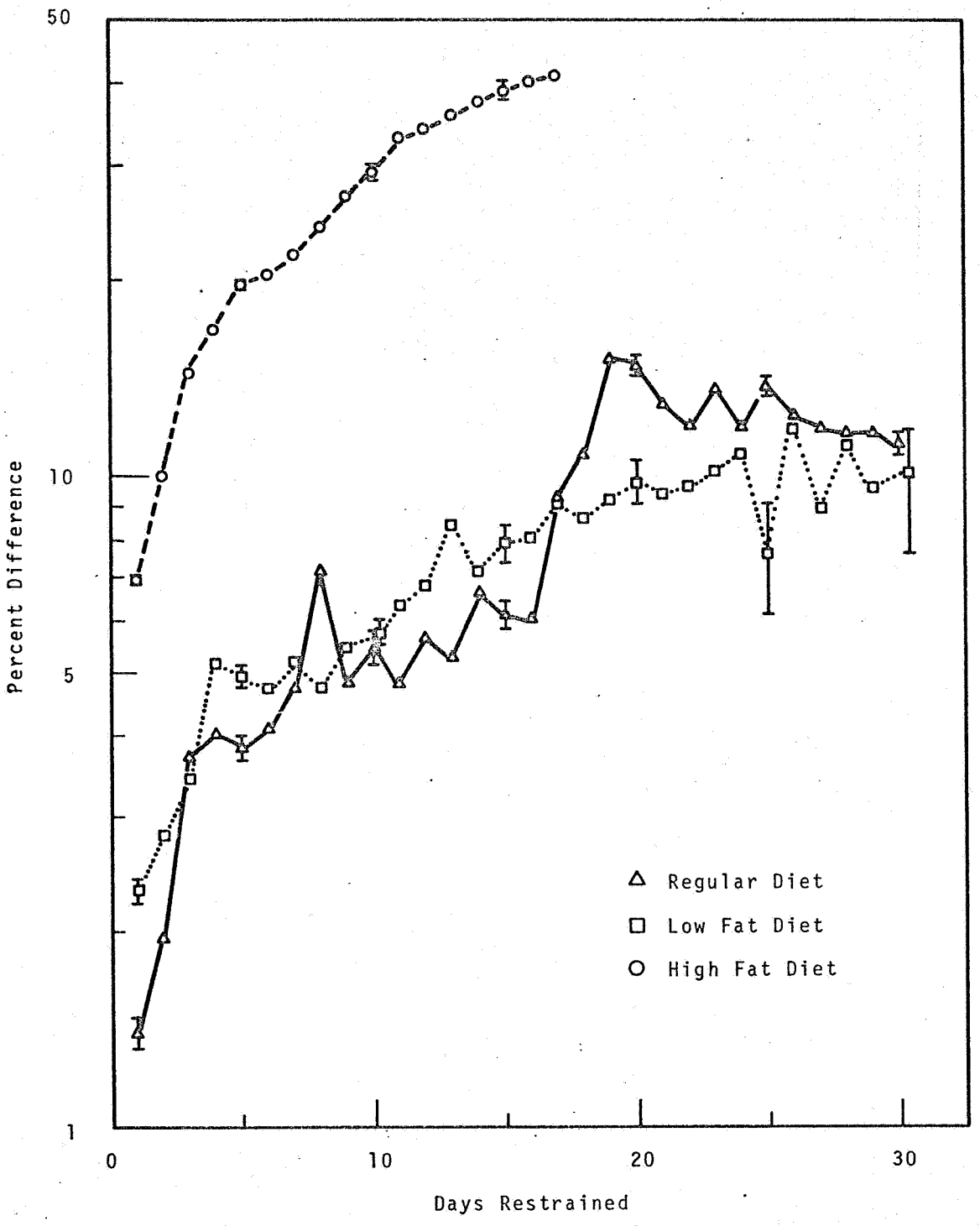

FIGURE 2
Mean Percentage Difference Between Restrained and Non-Restrained Rats on a Normal, Low Fat or High Fat Diet

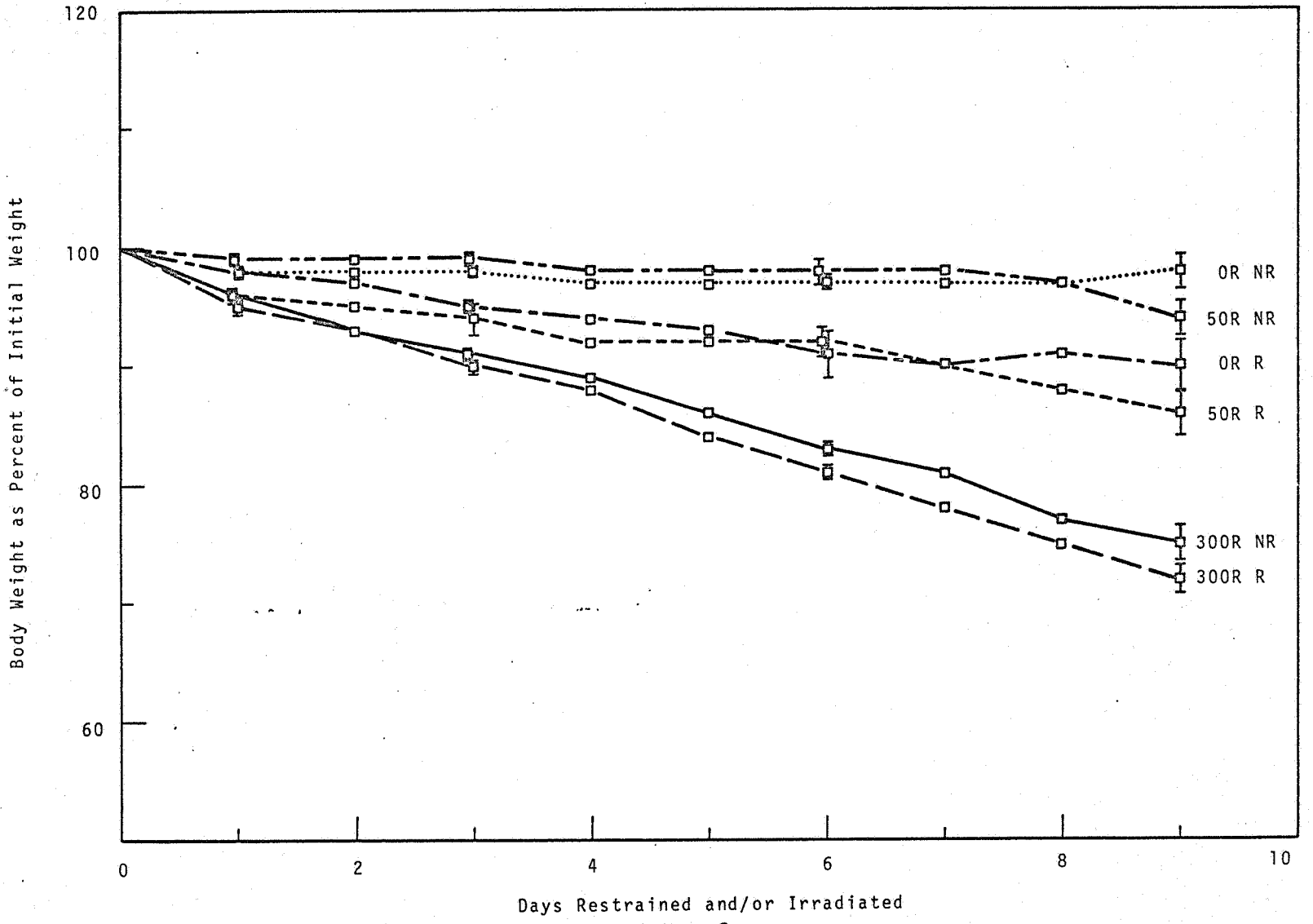

FIGURE 3

Body Weight Changes (as a Percentage of Initial Body Weight) of Restrained and Non-Restrained Rats Exposed to 0R/Day, 50R/Day or 300R/Day ^{60}Co Irradiation

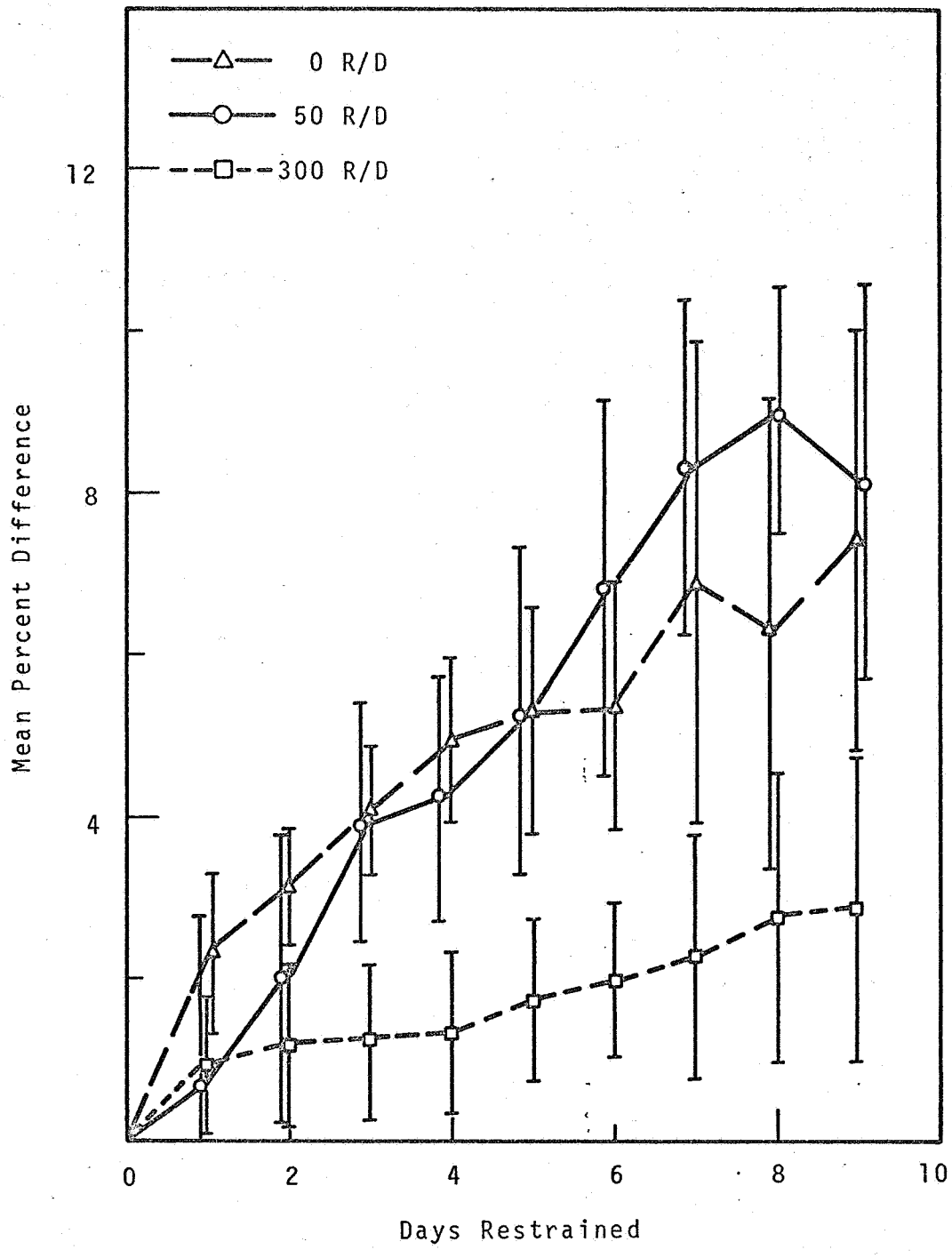

FIGURE 4
Mean Percentage Difference Between Restrained and Non-Restrained Rats Exposed to 0R/Day, 50 R/Day or 300 R/Day ^{60}Co Irradiation