

Effect of Sulfamerazine and Exercise on Life Span of Rats and Hamsters

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Abstract. Rats and hamsters of both sexes were divided into exercise and non-exercise groups with and without small amounts of sulfamerazine in the diet. In every case rats on exercise lived longer than their controls. The females outlived the males while hamster males lived slightly longer than females. Sulfamerazine had a significantly beneficial effect on life span of rats and apparently increased that of male hamsters. All rats fed sulfamerazine attained higher maximum weights than their controls. There was no consistent change in bone densities.

There have been many studies on the effects of short-term feeding of sulfa drugs on growth rate, performance and health of animals. But to our knowledge tests have not been reported to determine the effects of feeding these drugs over the entire life span of animals. Very little research has been carried out on the effects of exercise on the life span of rats and none appear to have been published on the effect on hamsters. In a series of studies *Slonaker* (1912, 1931 a, b) found that the type of diet had a marked effect and that female rats were more active than males.

This study was carried out to investigate the effects of feeding a relatively high level of sulfamerazine continuously on the health and longevity of rats and hamsters and to determine whether or not the drug would modify the causes of eventual death. *Habermann* (1959) had shown this drug as being beneficial in the 3rd, 4th and 5th generations. The effects of exercise and possible interactions between sulfamerazine and exercise on life span were also measured.

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Experimental Procedures

Female and male rats and hamsters were selected at weaning and assigned randomly within sex to one of two dietary treatment groups: (1) controls, or (2) sulfamerazine (250 mg/kg of diet). The diet groups were divided so that one part of each group was housed in standard individual cages. The rest were placed in cages equipped with an attached exerciser, which automatically recorded the distance the animal traveled each day (Richter and Wang, 1926–27). The animal could move from its cage into its exerciser at will. The rats were placed in the exercise cages at 80–100 days of age and the hamsters at about 32 days.

All animals were fed the same basal diet, a commercial dog meal (Big Red Dog Meal, Agway, Syracuse, N.Y.) *ad libitum*. Tap water was available continuously. They were housed in individual cages, in an air-conditioned room maintained at a temperature of $20 \pm 3^\circ\text{C}$. Bone density was measured by weighing the dry, fat-free humeri in air and in water (Lovelace *et al.*, 1958). A postmortem examination was performed on each animal that died to determine the cause of death.

Results

Life Span

The life span and maximum weights of the rats and hamsters are shown in table I. In each treatment group, the female rats lived longer than the males. As an average, the females lived 163 days longer (850 vs. 687) or 24% longer than the males. This is in line with previous studies (Slonaker, 1912; McCay *et al.*, 1941, 1943; Sperling *et al.*, 1955). In each comparison, the rats which had the opportunity to exercise outlived their mates that were housed in standard individual cages. As an average, the rats in exercise cages lived 81 days longer (809 vs. 728) than the control animals. Rats fed sulfamerazine lived significantly longer (170 days) than the controls.

The hamsters differed from the rats in life span pattern. The males lived an average of 42 days longer than the females (591 vs. 549) days. The average age at death for all the hamsters was 570 days. Animals allowed exercise lived 587 days compared to 554 days for the no-exercise controls. These differences are relatively small and not statistically significant with the small number of animals in the test. Feeding sulfamerazine had no effect on the life span of the hamsters, the life span being 569 vs. 571 days for the controls. Lovelace *et al.* (1958) reported that male hamsters lived over 800 days, about 200 days longer than females.

Body Weight

Rats fed sulfamerazine reached a heavier maximum live weight than the controls in each group. The average difference was 32 g between the treated animals and the controls. Exercise did not have any consistent effect on the

Table 1. Effect of exercise and sulfamerazine on the life span, maximum weight attained, and bone density of rats and hamsters

	Controls		Sulfa		Exercise			
					controls		sulfa	
	females	males	females	males	females	males	females	males
Rats								
Life span, days	671 ± 26 (20)	621 ± 34 (10)	914 ± 26 (20)	707 ± 27 (10)	802 ± 46 (8)	640 ± 26 (8)	1,013 ± 38 (8)	780 ± 21 (8)
Maximum body weight, g	240 ± 3	399 ± 11	290 ± 10	441 ± 8	259 ± 12	397 ± 11	266 ± 7	426 ± 9
Humeri density								
mean	1.28 (12)	1.28 (5)	1.29 (17)	1.27 (6)	1.39 (5)	1.28 (5)	1.30 (7)	1.22 (5)
range	1.20-1.36	1.19-1.41	1.16-1.38	1.11-1.50	1.28-1.46	1.17-1.42	1.22-1.41	1.11-1.34
Hamsters								
Life span, days	572 ± 35 (5)	537 ± 53 (5)	507 ± 61 (5)	631 ± 32 (5)	568 ± 19 (5)	606 ± 58 ¹ (5)	-	-
Maximum weight, g	147	151	141	144	157	161		

Figures in parentheses equals number of animals.

¹ The mean is 691 days if one animal which died at 266 days is excluded.

average live weight of rats on any treatment. Males were considerably heavier than the females, as expected with this species.

The average maximum live weight of the hamsters was 150 g. Males averaged 152 vs. 148 g for females. The similarity in body weight of the sexes is well known and is in striking contrast to rats and many other animals. It appears that neither exercise nor the feeding of sulfamerazine had any consistent effect.

Bone Density

The densities of the humeri of the rats measured after they died are summarized in table I. In the case of rats exercised, the females tended to have denser bones than the controls, but there was no consistent effect among the males. Sulfamerazine appeared to decrease bone density of both females and males in exercise cages, but not of rats in standard cages, and any differences were very small.

Effects of Exercise

The amount of exercise might be expected to have some influence on life span and body weight of the animals. Table II shows the distances the rats and hamsters traveled. Female control rats traveled nine times farther than males, while those fed sulfamerazine traveled only four times as far. The greater activity of female rats is in agreement with earlier reports (*Hitchcock*, 1925–26). There does not appear to be any interrelationship between feeding sulfa and the amount of exercise and life span since the females ran less but lived longer. The shorter average distance traveled per day by the female rats fed sulfamerazine (4.72 km) compared to that of the control females (6.46 km) may be due to the 243 day (36%) longer life, since the amount of voluntary exercise decreases with age (*Jones et al.*, 1953). Only one male traveled as far as any female.

Table II. Voluntary exercises of the rats and hamsters

Animals			Distance traveled, km/day	
			mean	range
<i>Rats</i>	Controls	females	6.46	2.96–11.12
		males	0.82	0.10–1.41
	Sulfamerazine	females	4.72	2.69–7.17
		males	1.17	0.34–3.28
<i>Hamsters</i>	Controls	females	5.65	4.5–6.9
		males	5.57	3.5–6.7

There was no important difference between male and female hamsters in the amount of exercise recorded, and unfortunately data were not obtained on the possible effect of the sulfa drug on exercised hamsters.

It is acknowledged that no attempt was made to measure the activity of the animals in the standard cages. Based on observations of the researchers, it is thought that animals housed in the exercise cages spent much more time running than the others, but it is possible that the activity of the controls varied considerably.

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