Proceedings of the Iowa Academy of Science

Volume 64 | Annual Issue Article 82

1957

Some Factors Influencing the Life Span of Golden Hamsters

R. E. Grindeland
State University of Iowa

G. E. Folk Jr.
State University of Iowa

R. L. Farrand
State University of Iowa

Some Factors Influencing the Life Span of Golden Hamsters[1]

By R. E. GRINDELAND, G. E. FOLK, JR., AND R. L. FARRAND

The golden hamster has found increased use as a laboratory animal over the last two decades. It is of particular interest because it hibernates although its periods of dormancy are short compared to those of other hibernators (1). The complete spectrum of physiological norms should be determined for this common animal just as they were for the laboratory rat. In the list of normal values for the hamster there is little published information on life span (2). This paper will present records of life spans of 126 hamsters kept under controlled laboratory conditions. Approximately 43% of the colony were maintained with a daily light cycle in a coldroom (6 ± 2° C.) for about 4 months each winter. Other conditions of the experiment have been described earlier in detail (1). For the purposes of this analysis the cold-exposed group was treated as a homogenous population, in spite of the fact that some of the animals hibernated. This combining of animals was due to the fact that there was such variation in the total duration of hibernation over the winter periods. Some hamsters hibernated for one day, others were in hibernation for a total of 95 days. The systematic pattern of results justifies this approach to this analysis. To be specific, the data treated in this paper look as if cold-exposure with or without hibernation produced the same effects upon the animals, in most respects. Furthermore, the hibernators were distributed nearly equally among four groups of cold-exposed animals. Later analyses will attempt to consider the influence of hibernation as a separate factor. We will refer in this report only to the cold-exposed group: this means a mixed group of males and females of two strains of animals, most of which were cold-exposed 4 months, but a few of which received only 3 months of cold-exposure at 6° C. and a few weeks at 16° C. About 12 of the males and 10 of the females hibernated for variable periods of time.

As far as the observers could determine, the time of death indicated the natural life span of caged hamsters. The cages were checked at least daily for dead animals, and gross autopsies were completed as soon as possible. Hearts, kidneys, and spleens were weighed.

[1]This research was supported by the National Science Foundation and the Central Scientific Fund, College of Medicine, State University of Iowa.

RESULTS

The control animals of both sexes lived longer than hamsters which died in the cold room ($p < 0.003$) (see Table 1). Sexes were analyzed separately. Males which died in the coldroom lived longer than females ($p < 0.04$). Note that all comparisons were significant. These age differences did not hold for males and females maintained at room temperature.

The hamsters which survived 4 or 8 months of cold exposure represent a particularly interesting group, comprising about 50% of the cold-exposed group. In this group of survivors the males lived longer than the females ($p < 0.01$). The mean lifespan of the male survivors was 670 days, compared with 601 for the control males. Although the difference in these lifespans is not statistically significant, the figures suggest that some factor such as the elimination of the weaker specimens, is acting. The ages of the female coldroom survivors and the female controls were approximately the same. The maximum lifespans are of interest: the oldest 10 males had lifespans ranging from 812 to 993 days. Meyers and Charipper mention hamsters of about 810 days of age (4).

To summarize, the data on lifespans suggests: (1) there is a selection factor in the survival population in coldroom experiments, and (2) male hamsters are less sensitive to the effects of cold exposure than females. The latter observation warrants further investigation.

At autopsy several large organs were weighed despite possible variation of total body weight due to unequal periods between death and post mortem (see Table 2). This procedure was profitable for descriptive purposes although the only significant change was one in kidney weight, expressed as per cent of body weight of cold-exposed animals. This observation held for both males and females which died in cold, or survived cold (in all cases $p < 0.003$). Similar evidence is described in a recent study by Farrand (3) who showed an increase in the absolute weight of the kidneys and hearts in hamsters subjected to two weeks of cold exposure. The other organ weighed in the present study was the spleen. Results indicate a decrease in absolute weight of this organ in coldroom animals in three of the four groups (male coldroom deaths, male and female coldroom survivors) at the 5% level of confidence, or lower. Finally, in respect to male and female comparisons of organ weights, in every instance the organ weights of females were larger than those of comparable males on both an absolute and a per cent basis. It should also be noted that all animals in the cold lost total body weight, mostly in the form of fat.

The major causes of death as determined by gross autopsies were hemorrhage of the abdominal viscera, hepatic fibrosis, and hepatic cysts. The findings on fibrosis and cysts may represent natural causes of death in aging hamsters under control conditions since only older hamsters showed this pathology (mean lifespan: males 601 days, females 616). The survivors of the cold-exposure showed this same trend. Additional support to the view that this pathology is age-associated is the fact that it did not occur in animals which died in cold-exposure, all at a young age. Abdominal hemorrhage and ascites were found in young animals only in those which died in cold-exposure. Note that 88% of the males which died in cold-exposure had abdominal hemorrhages, and their mean lifespan was only 294 days, while 29% of the control males had this pathology but a mean lifespan of 643 days.

Gonadal atrophy is usually associated with aging. This does not appear to be the case with hamsters, although in this study the reproductive state was only visibly estimated. It appears that only one-half to one-third of the animals which died in the warm room showed gonadal atrophy at time of death. The high per cent of gonadal atrophy in animals which died in the cold, would probably be described more accurately as sexual quiescence.

Summary

1. The mean lifespan of 72 hamsters maintained under typical laboratory colony conditions (24° C.) was 601 days for males and 616 for females. It is supposed that this represents the natural lifespan of caged hamsters.

2. The mean lifespan of hamsters exposed for 4 months each winter at 6° C. was 670 for males and 601 for females if they survived the period in the cold; and for animals which died during exposure the mean was 365 days for males and 284 for females. Apparently female hamsters are more sensitive to cold than males.

3. Cold exposure appears to act as a stress since 50% of this group died in the coldroom at a mean age of 334 days. Apparently the male hamsters which survived showed some influence of selection since the mean lifespan (670 days) of this group was 11% greater than that of male hamsters maintained in the warm room. This observation did not hold for the female hamsters which survived the cold.

4. At autopsy the hearts and kidneys appeared hypertrophied in cold-exposed animals. The present study demonstrated a significant increase in kidney weight expressed as per cent of body weight in cold-exposed animals. A companion study shows in addition, an

Table 1

Life Span of the Golden Hamster
(Mean Values in Days ± 1 S.D.)

	Warm Room	Died During Cold Exposure	Survived Cold Exposure
Males	601 ± 34 (n = 42)	365 ± 20 (n = 16)	670 ± 25 (n = 18)
Females	616 ± 33 (n = 30)	284 ± 5 (n = 10)	601 ± 21 (n = 10)

Table 2

Organ Weights in Grams and Per Cents of Body Weight at Autopsy (N:118)

	Male			Female		
	WR	CD	CS	WR	CD	CS
Heart Weight (absolute)	0.64	0.51	0.68	0.75	0.58	0.71
Heart Weight (per cent)	0.71	0.78	0.84	0.83	0.86	0.95
Spleen Weight (absolute)	0.19	0.09	0.11	0.22	0.12	0.12
Spleen Weight (per cent)	0.21	0.13	0.14	0.23	0.18	0.16
Kidney Weight (absolute)	1.28	1.28	1.46	1.51	1.56	1.74
Kidney Weight (per cent)	1.40	1.93	1.79	1.65	2.28	2.27

WR: Warm room = typical laboratory colony conditions.
CD: Died during cold exposure.
CS: Survived cold exposure.

Table 3

Autopsy Findings on Golden Hamsters (N:118)

	Males			Females		
	WR	CD	CS	WR	CD	CS
Hepatic Fibrosis:						
Incidence (%)	26	—	17	33	—	10
Age (days)	701	—	713	624	—	615
Hepatic Cysts:[1]						
Incidence (%)	7	—	17	27	—	—
Age (days)	612	—	672	668	—	—
Abdominal Hemorrhage:						
Incidence (%)	29	88	22	43	40	—
Age (days)	643	294	673	645	274	—
Ascites:						
Incidence (%)	12	24	6	10	—	20
Age (days)	786	279	499	574	—	645
Gonadal Atrophy:						
Incidence (%)	45	63	28	37	30	30
Age (days)	664	305	611	669	299	445

WR: Warm room = typical laboratory colony conditions.

CD: Died during cold exposure.

CS: Survived cold exposure.

[1]Dr. Frederic W. Stamler of the College of Medicine, State University of Iowa, kindly examined the specimens with this pathology andd studied histologic sections of the liver tissue. He tentatively suggests the description: "cystic malformations which are probably congenital and probably non-malignant."

increase in the absolute weight of the heart and kidney during the first 15 days of cold exposure.

5. The absolute weight of the spleen decreased in all cold-exposed animals.

6. Gross autopsies showed that the major causes of death are hemorrhage of the abdominal viscera, hepatic fibrosis, and hepatic cysts. Many animals that died during cold exposure showed no gross pathology.

References

1. Folk, G. E., Jr., and R. L. Farrand. 1956. Characteristics of hibernation of the golden hamster. Brit. J. Anim. Tech. Assoc. 6: (5).
2. Bulletin of the General Biological Supply House; Service Leaflet no. 53.
3. Farrand, R. L., and G. Edgar Folk, Jr. 1957. Responses of hamsters during first two weeks of cold exposure. Fed. Proc. 16: 35.
4. Meyers, Marcia W., and Harry A. Charipper. 1956. A histological and cytological study of the adrenal gland of the gold hamster (*Cricetus auratus*) in relation to age. Anat. Rec. v. 124, no. 1.

DEPARTMENT OF PHYSIOLOGY
COLLEGE OF MEDICINE
STATE UNIVERSITY OF IOWA
IOWA CITY, IOWA