Scand. J. Lab. Anim. Sci. No. 3 . 1989 . Vol. 16

Technical note Communication: Frequency of cage changing and weight gain in rats

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INTRODUCTION

Almost 30 years, *Steinberg* and *Watson* (1960) reported that daily change of cage caused temporary arrest of growth in rats. However, the design of the studies of *Steinberg* and *Watson* (1960) do not allow unequivocal conclusions to be drawn. Control and test animals differed with regard to pre-experimental conditions, and the test animals subjected to cage changing were handled more frequently than the controls. Thus the influence of cage changing per se cannot be assessed. This prompted us to subject groups of young rats to various frequencies of cage changing while accounting for possible handling effects by sham cage changing of control rats.

MATERIALS AND METHODS

Female rats were derived from the conventional outbred Wistar Cpb:WU strain of the Laboratory Animals Centre, Agricultural University, Wageningen. The animals were fed a pelleted, commercial diet (RMH-B^R, Hope Farms, Woerden, The Netherlands).

From the age of 3 weeks the rats were housed in groups of 5 or 6 in wire-topped Makrolon type III (37.5 × 22.5 × 15 cm) cages (UNO BV, Zevenaar, The Netherlands) with a layer of wood shavings (Woody Clean Shavings^R, Broekman Institute, Helmond, The Netherlands) as bedding. After another week the rats were housed individually in Makrolon type II cages (22.5 × 16.7 × 14 cm). At the age of 5 weeks (Day 0) the rats were divided into 5 groups of 8 animals each, so that group mean body weights were similar. The cages were placed at random in racks which were located in a room with air conditioning (21°C), controlled lighting (light: 0600-1800 h) and humidity (55-65%). Food and tap water were provided ad libitum.

During the experimental period (Days 0-14), the rats of groups 1 to 4 (Table 1) were weighed daily between 08.00 and 10.00 h. The cage was removed from the rack and placed next to the electronic balance. Subsequently, the animal was removed from the cage and weighed. The individual animals were weighed in random order. Upon weighing, the rat was either placed back into its home cage (sham cage changing) or into a clean, though otherwise similar cage with fresh bedding (true cage changing). The frequencies of sham and true cage changing differed per group, and are shown in Table 1. The animals of group 5 (Table 1) were weighed and their cages cleaned once a week; otherwise these rats were not disturbed. The experiment lasted 14 days.

The Tukey's *w*-test was used to compare group means of body weight and gain for statistically significant differences.

RESULTS AND DISCUSSION

Table 1 shows that the frequency of cage changing affects body weight gain of young female rats. At the end of the experiment, group mean body weight was highest of the animals whose cage had not been changed (group 4). During the first week of the experiment cage changing at a frequency of once every day or once every three days resulted in significantly lower weight gain than cage changing once every 14 days (groups 1 and 2 versus group 4). During the second week of the experiment a similar tendency was seen, but the differences did not reach statistical significance. Possibly, the rats became familiar with frequent cage changing which was associated with diminished stress induced by the environmental changes.

The rats of groups 1 to 4 only differed concerning the frequency of cage changing, and the

Table 1. Growth performance of rats subjected to different frequencies of cage changing.

	Frequency of cage changing (times/days)[1]		Body Weight (g)		Weight gain (g)	
Group	True changing	Sham changing	Day 0	Day 14	Days 0-7	Days 7-14
1	1/1	0/1	72.0±7.0	124.6±13.6^{a,b}	29.0±6.8^{a}	23.6±7.3
2	1/3	2/3	70.7±5.5	123.5±7.8^{a}	29.5±5.1^{a}	23.4±3.9
3	1/7	6/7	71.0±6.5	129.1±7.5^{a,b}	34.4±2.7^{a,b}	23.8±5.9
4	1/14	13/14	71.2±5.6	136.8±7.6^{b}	36.9±4.3^{b}	28.7±3.2
5	1/7	0/7	71.5±6.8	129.3±5.2^{a,b}	31.9±3.2^{a,b}	25.8±4.0

[1]Each day between 08.00 and 10.00 h either true or sham cage changing (see text) took place, except for group 5 which was weighed and cleaned once a week. Means ± SD for 8 rats per experimental group. Values not sharing a common superscript are significantly different ($P < 0.05$) between the treatments.

study design excludes a bias due to differences in handling. Rats placed in clean cages once every 7 days and left undisturbed otherwise, grew at similar rates as the animals that underwent sham cage changing six times every 7 days (group 5 versus 3, Table 1). Thus it would appear that handling per se has no major impact on growth. Similar conclusions were reached in studies with rats (*Cowley & Widdowson,* 1965) as well as mice (*Porter & Festing,* 1969).

Cage changing represents a stressful event for rats, so-called novelty stress, as indicated by the observed increase in the plasma concentrations of corticosterone (*Armario et al.,* 1986) and catecholamines (*De Boer et al.,* 1988). This in turn probably diminishes growth. From the standpoint of welfare of laboratory rodents, an optimal frequency of cage changing or an optimal mode of cage changing should be formulated. As yet, there are no sufficient data to do so. From the standpoint of quality of animal experiments, it seems advisable to standardize the frequency of cage changing both within and between experiments.

Summary

We have studied the influence of the frequency of cage changing on body weight gain in young female rats over a 2-week period. Rats were subjected to either true or sham cage changing so as to balance for possible effects of handling. Cage changing once every day or once every three days caused significantly lower rates of weight gain in the first but not second week of study than did cage changing once every 14 days. It is suggested tentatively that stress associated with cage changing is responsible for the observed growth inhibiting effect.

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