
Brief Report—Communication brève

Should Large Rats Be Housed in Large Cages? An Empirical Issue

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Abstract

The Canadian Council on Animal Care (CCAC) has recently started to suggest that large rats should be kept in cages that are 23 cm high, rather than in the 17.5 to 18 cm high cages that are currently standard throughout North America. In the present experiment, eight large rats (489 to 623 g) were each allowed to choose for 24 hr between a 16.8-cm-high cage and a 23-cm-high cage. The rats failed to exhibit any preference for the higher cage. It is suggested that before the CCAC mandates commitment of substantial resources for a change in the conditions of laboratory animal maintenance, some objective evidence should be provided that the proposed change improves the well being of animals.

Decisions concerning the size cage appropriate for housing each species of laboratory animal can have important consequences both for the health and comfort of cage occupants and for the future of animal-based research. If caged animals are prevented from engaging in all of the behaviours that they exhibit when living free, then they may suffer distress (Hughes & Duncan, 1988; Baxter, 1983; Dawkins, 1983). On the other hand, if limited resources available for animal-based research and animal maintenance are committed to the purchase of new cages, those resources can not be used either to make other improvements in other condi-

tions of animal maintenance or to undertake research, the conduct of which is the reason why animals are held in laboratory cages in the first place.

Existing standards for laboratory animal caging are not based on objective data. Rather, they have evolved over many years with revisions based on professional judgement and subjective evaluations of caging systems (Lawlor, 1990; National Aeronautic and Space Administration, 1990). Such informal development of standards for laboratory animal caging does not inspire confidence that cages in use today are of optimal design. On the other hand, proposed changes in cage design based on similar subjective judgements also fail to inspire confidence that the proposed changes will have the intended result of enhancing the well being of cage inhabitants.

Recently, the Canadian Council on Animal Care (CCAC) has begun to suggest that large rats should be maintained in 23-cm high cages, rather than in the 17.78 cm high (National Institutes of Health, 1985) to 18-cm high (Canadian Council on Animal Care, 1980) cages that are the current standard throughout North America. This recommendation is based on Weihe's (1987, p. 314) assertion that "It is now recognized that rats like to run, stand on their hind legs and jump" taken together with the observation that "presently available caging does not permit this." Weihe (1987, p. 314) concluded that "higher cages are better because they allow the rat to use all its skeletal muscles by providing a greater height for free movement" and references Lawlor (1984) in this regard. Lawlor (1984), in turn, criticizes the 14-cm height adopted as standard for rat cages by the Council of Europe Convention because adult rats in such cages can not

stand bipedally or adopt a normal orienting stance. Her proposals are based on the unsupported assertion that, although behaviour patterns that contribute to survival in nature are modifiable, such adaptation is not achieved without discomfort.

In a subsequent publication, Lawlor (1990) presents both measurements of rats from rump to nose and estimates of the minimum cage sizes that would permit rats of various sizes to stand and turn without modification of their unrestricted movements. Lawlor proposes, for example, that a typical adult female rat (170-310g) would require a cage 22-cm-high and 1500 cm² in floor area, while a large female rat (310-615g) would require a cage 26-cm-high by 1800 cm². If, as is implicit in CCAC (1991), the CCAC has accepted Lawlor's conclusions, the present proposed change in guidelines concerning cage sizes for rats is inadequate. Even the proposed new, higher cages will soon have to be replaced by yet higher and larger ones.

The decision to change a guideline regarding the size of rat cages will have substantial consequences. Replacing the current stock of rat cages in Canada will impact budgets both for animal-based research and for animal care throughout the country. Before making such a commitment of resources it would seem reasonable to undertake some objective inquiry to determine whether the proposed change in cage standard would actually improve the lives of cage inhabitants.

All caged animals are prevented to greater or lesser degree from engaging in behaviours that they would exhibit if they were living free. Lack of opportunities to engage in some species-typical behaviours, as Dawkins (1977, p. 1035) has proposed, "alert as to the possibility of suffering." In contrast to physical injury or ill health, however, the absence of some particular activity does not in itself constitute evidence of suffering or discomfort (Dawkins, 1990).

In a recent review of methods for determining those aspects of animals' environments which cause them distress, Dawkins (1990) proposed that an animal's preferences

give a first indication of those aspects of the environment which they find distressful. For example, by allowing large rats to choose between 16.8-cm and 23-cm high cages, one could provide evidence relevant to the question of whether rats find 16.8-cm high cages less comfortable than 23-cm high cages.

Hens in Pens

It might be argued that such studies are unnecessary because animals will always prefer the largest spaces available to them. However, laboratory rats are descendants of animals evolved to spend most of their lives in subterranean burrows. These burrows consist of tunnels averaging only 7.5 cm high and 8.3 cm wide that connect nesting chambers averaging 14.5 cm high × 22.1 cm long × 18.4 cm wide (Calhoun, 1962). It is not self evident what size cage laboratory rats would prefer to occupy. Further, results of previous studies of enclosure-size preferences in domesticated species other than rats suggest that our intuitions concerning the types of enclosures that animals prefer are not always confirmed by objective investigation. For example, Dawkins (1977) found that domestic hens exhibited no preference between cramped, commercial battery cages and a large pen, when given a simultaneous choice between the two.

The present experiment was undertaken to explore the preferences of rats allowed to choose between cages 16.8 cm and 23 cm in height. It was assumed, following Dawkins (1977, 1990), that if rats found 16.8-cm high cages less comfortable than 23-cm high cages, they would spend more time in 23-cm high cages than in 16.8-cm high cages.

Four male Long-Evans rats weighing an average of 594.0 g, and four male Sprague-Dawley rats weighing an average of 554.5 g served as subjects. All eight animals had been obtained as juveniles from Charles River Canada (St. Constant, Quebec) and all had spent most of their lives in the McMaster Psychology Department vivarium, where they were maintained on ad lib Purina Rodent Laboratory Chow #5001 and water in pairs in

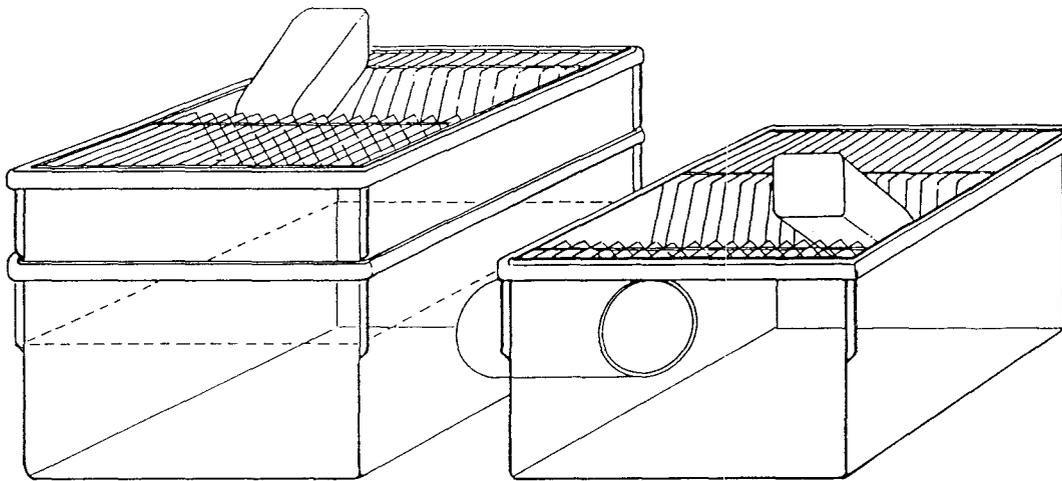


Fig. 1 Drawing of the apparatus used in the experiment.

standard ($37.8 \times 32.7 \times 16.8$ cm) polycarbonate shoe-box rat cages (Canlab, Mississauga, Ontario Catalogue #A4551-3) with wire lids (Canlab Catalogue #A4564-4).

Throughout the 7 days of the experiment, each subject was housed individually in the apparatus illustrated in Figure 1. The apparatus was constructed by opening a 7-cm diameter circular hole in one of the side walls of each of two $37.8 \times 32.7 \times 16.8$ cm polypropylene cages (Canlab, Mississauga, Ontario Catalogue #A4551-2) and connecting the cages by inserting a 10-cm length of 7-cm diameter PVC tubing 1.0 cm into each cage. Another $37.8 \times 32.7 \times 16.8$ cm polypropylene cage from which the bottom had been removed was stacked in one of the two connected cages to make a cage 23 cm high.¹ Subjects could move freely between 16.8- and 23-cm high cages. Both cages were closed with wire lids (Canlab Catalogue #4546-4) and both had 30 pellets of Purina Rodent Laboratory Chow #5001 and water bottles placed in their lids.

Behaviour of subjects was recorded using a Panasonic AG 6720 time-lapse VHS video-cassette recorder (recording 24 h of behaviour on 1 hr of tape) with time-date gener-

¹ Specially constructed 23-cm-high cages were used because 23-cm-high cages are not yet available commercially in Canada.

ator and a CL110 Panasonic Colour CCTV camera with WVPS-10A Camera Drive Unit. Tape recordings were viewed on a Panasonic ct 1331YC, 13-in colour monitor.

To begin the experiment, an individual rat was placed in an apparatus and left for either 5 or 6 days to become accustomed to its new home. On the afternoon of either the 5th or 6th day of the experiment, the video camera and video-cassette recorder were turned on and left running for 24 hr.

After the behaviour of all eight subjects had been recorded, the video tapes were given to a naive observer who was asked to determine the amount of time that each subject spent in the higher and lower parts of the enclosure, and to calculate the percentage of time that each subject spent in the higher area. One of the authors (B.G.G.) independently carried out the same observations and analysis. The percentage scores arrived at by the two independent observers were then correlated. The Pearson Product Moment Correlation of the percentage scores awarded by the two observers was 0.999.

No Preference

The main results of the experiment are presented in Figure 2 which shows the percentage of the 24-hr observation period that each of the eight subjects in the experiment spent in the 23-cm-high side of the apparatus.

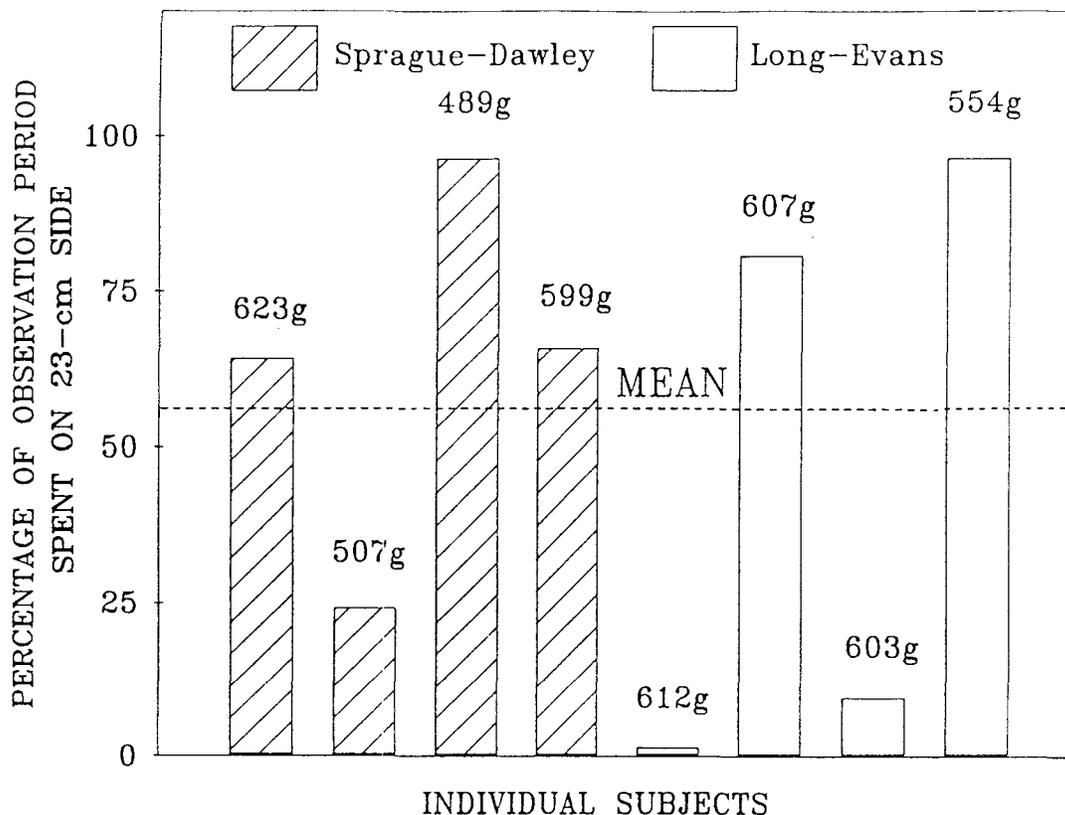


Fig. 2 Percentage of the 24-hr test period that each of four Sprague-Dawley and each of four Long-Evans rats spent on the 23-cm-high side of the apparatus. The weight of each subject is shown above the histogram describing its behaviour. The mean for the group of eight animals is indicated by the dashed line.

As can be seen in Figure 2, 5 of the 8 subjects spent more time on the 23-cm-high than on the 16.8-cm-high side of the enclosure (Binomial Test, $p = 0.363$) and, on average, subjects spent 54.7 ± 13.5 percent of the 24-hr test period on the higher side of the apparatus. There was, thus, no preference exhibited by rats for cages higher than the current standard relative to cages lower than the current standard.

Obviously, the results of the present study do not provide definitive evidence that large rats are indifferent as to whether their cages are 16.8 cm or 23 cm high. The null hypothesis cannot be proven. However, the results equally clearly fail to provide support for the hypothesis, underlying the proposed change in CCAC guidelines, that rats are more comfortable in 23-cm high cages than in 16.8-cm high cages. In the absence of such evidence,

allocation of hundreds of thousands or millions of dollars to increase the height of rats' cages across Canada is difficult to justify.

There is, of course, a larger issue involved here than that of how high the cages of rats should be. That larger issue concerns the way in which modifications to existing guidelines for animal care and maintenance should be justified before they are promulgated. Appeal to intuition, to professional judgement or to poorly substantiated or narrowly held theories is not adequate justification for commitment of scarce resources. Whenever possible, before resources for animal maintenance are allocated for one purpose rather than for another, objective evidence of the benefits of resource allocation needs to be provided and consideration given to alternative expenditures directed towards complementary goals.

The animals in our care, the research community, and the taxpaying public, all would be well served by empirical investigations into the benefits of proposed changes in animal care guidelines before such changes are adopted formally and scarce resources are committed to their implementation. There is an obvious need for targeted funding for such behavioural research within the Canadian system.

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Résumé

Le Conseil canadien de protection des animaux vient récemment de proposer qu'on mette les rats de grande taille dans des cages qui font 23 cm de hauteur au lieu de cages dont on se sert actuellement en Amérique du Nord, qui font entre 17,5 et 18 cm de hauteur. Les rats n'ont manifesté aucune préférence pour la cage plus grande. Dans le présent rapport, nous suggérons qu'avant que le Conseil exige que l'on consacre des sommes d'argent importantes pour changer les conditions de vie des animaux de laboratoire, il faudrait démontrer concrètement et objectivement que les changements proposés amélioreront le bien-être des animaux.

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