Scand. J. Lab. Anim. Sci. No. 3 . 1992 . Vol. 19

Technical note Communication:

Wood gnawing in mice is not associated with open-field behaviour

by *C. M. Omtzigt*[1], *F. A. R. Van den Broek*[1] & *A. C. Beynen*[1,2]

[1] Chair of Laboratory Animal Science, Agricultural University, P. O. Box 8129, 6700 EV Wageningen,
[2] Department of Laboratory Animal Science, State University, P. O. Box 80.166, 3508 TD Utrecht, The Netherlands.

Introduction

Knowledge of behavioural needs of laboratory animals is of great importance in attempts to improve their welfare. One problem is that different strains of rodents might have different needs to perform certain behavioural activities. For instance, in mice there are large individual as well as strain differences in wood gnawing (*Barnett & Scott* 1964, *Fawdington & Festing,* personal communication). This might imply that mice strains differ in their need for nibbling material. However, it could be suggested that wood gnawing is a reflection of an exploratory drive. In order to obtain clues concerning this suggestion, we addressed the question whether open-field behaviour, which is often used as a measure of exploratory behaviour (*Archer* 1973), and wood gnawing are correlated in mice of two strains.

Materials and methods

We used 30 mice (16 females, 14 males) of the A2G inbred strain, and 28 mice (14 females, 14 males) of the NMRI outbred strain. The strains were maintained in the Laboratory Animals Centre, Agricultural University, Wageningen. At the age of about 21 days, the animals were weaned and housed in pairs based on the same strain, sex and age. Most pairs consisted of siblings. At the start of the experiment, the A2G mice were aged about 120 days and the NMRI mice about 80 days.

Pairs were housed in polycarbonate, wire-topped Makrolon type II cages (22.5×16.7×14 cm) with a layer of wood shavings as bedding. The cages were located in a room with controlled temperature (22–24°C), humidity (55–65 %) and lighting (light, 06.00–18.00 h). Commercial diet pellets (RHM-B®, Hope Farms, Woerden, The Netherlands) and tap water were supplied ad libitum.

Each mouse underwent twice a wood gnawing plus open-field test. Half of the mice of each strain were subjected of the wood gnawing test followed by the open-field test, the interval being four days. The other half underwent the two tests in opposite order, with an interval of two days. When the two tests were repeated one week later, the order for each mouse remained unchanged. At the beginning of the tests, the tail of each animal was marked with a water-proof felt tip.

For the wood gnawing test, the mice were placed individually in a clean cage. About five hours later (between 15.00 and 16.00 h), a block of balsa wood (2.3×2.5×5 cm) with known weight was put on the floor of each cage. After 46 hours, the blocks were removed and weighed. The pairs were then reunited in a clean cage. Before weighing, the wood-blocks were dried for one hour at 134°C.

Open-field behaviour in a perspex square field (45×45×45 cm) was monitored for five minutes. The floor was divided into nine equal squares. A mouse was placed in the centre of the square field and the following six activities were registrated: ambulation (number of lines crossed), rearing, rearing against the wall, grooming, defecation and

Table 1. Balsa wood gnawed by mice of the A2G and NMRI strains.

Strain	Test	Wood gnawed[1]
A2G (n = 30)	1	0.79 ± 0.55
	2	0.69 ± 0.41
	1+2	0.74 ± 0.38
NMRI (n = 28)	1	1.32 ± 0.87[a]
	2	1.46 ± 0.88[a]
	1+2	1.39 ± 0.76[a]

[1] g/46 h. Means ± SD. Test 1+2 refers to averaged values per individual mouse for the two tests.
[a] Significantly different: NMRI versus A2G mice ($p < 0.01$; 2-tailed Student's t-test).
[b] Significantly different: test 2 versus test 1 within strains ($p < 0.01$; 2-tailed Student's t-test).

urination. After testing each mouse, the field was cleaned thoroughly with alcohol. The animals were tested between 10.00 and 12.00 h.

Results and discussion

Table 1 shows that NMRI mice gnawed significantly more wood than A2G mice. The within-strain variation was on average 64 % (coefficient of variation). In the open field, NMRI mice reared against the wall significantly more often and showed significantly more ambulation than A2G mice (Table 2). Thus, NMRI mice were more active in the open field and gnawed more wood. This might suggest that wood gnawing is a reflection of exploration. To test this suggestion, Spearman's correlation coefficients were calculated for the amount of wood gnawed (test 1+2, Table 1) and the various aspects of open-field behaviour in individual mice (test 1+2, Table 2). Neither for NMRI nor for A2G mice significant correlations were found (Table 3), indicating that wood gnawing and open-field behaviour do not have a common basis.

Table 3. Spearman's rank-correlation coefficients for wood gnawing and open-field behaviour.

Open-field behaviour	Correlation with wood gnawing	
	A2G	NMRI
Rearing	0.01	0.15
Rearing against wall	–0.20	0.37
Ambulation	–0.09	–0.02
Grooming	0.23	–0.14
Urination	0.30	0.08
Defecation	0.24	–0.06

Although both the wood gnawing and open-field tests measure exploration, the nature might be quite different. In the wood gnawing test, the animal's reaction towards a new object in its familiar environment is measured for a relatively long period. The mouse explores the new object by gnawing, but also by sniffing. Defense reactions, like avoidance and burrying, or urination may also occur. Eventually, novelty of the wooden block disappears and behaviours such as nest building may follow. In the open field, the animal's behaviour in a completely new environment is measured for a short period. Exploratory behaviours such as rearing and ambulation are registra-

Table 2. Open-field behaviour of A2G and NMRI mice.

Strain	Test	Rearing[1]	Rearing against wall[1]	Ambulation[1]	Grooming[1]	Urination[1]	Defecation[1]
A2G (n = 30)	1	11 ± 8	24 ± 10	47 ± 21	3 ± 2	1 ± 1	5 ± 2
	2	2 ± 3[b]	9 ± 6[b]	19 ± 14[b]	3 ± 2	1 ± 0	6 ± 3
	1+2	6 ± 5	17 ± 7	33 ± 15	3 ± 2	1 ± 0	6 ± 2
NMRI (n = 28)	1	6 ± 7	45 ± 9	165 ± 56	1 ± 1	1 ± 1	4 ± 2
	2	4 ± 6	43 ± 14	171 ± 66	1 ± 1	0 ± 1	4 ± 2
	1+2	5 ± 6	44 ± 10[a]	168 ± 58[a]	1 ± 1	0 ± 0	4 ± 2

[1] Times/5 min. [2] Boli/5 min. See Legend to Table 1.

Table 4. Spearman's rank-correlation coefficients for repeated measurements.

Measurement	Correlation coefficient	
	A2G	NMRI
Gnawing	0.31	0.44[a]
Rearing	0.29	0.75[b]
Rearing against wall	0.49[a]	0.60[b]
Ambulation	0.29	0.43
Grooming	0.41	0.24
Urination	0.18	0.14
Defecation	0.57[b]	0.26

Statistically significant correlation: [a] $p = 0.01$; [b] $p = 0.001$.

ted, but many behaviours, such as sniffing and turning of the head, are performed whilst stationary. Thus, it can be appreciated that open-field behaviour and wood gnawing were not correlated.

Another explanation for the lack of correlation between open-field behaviour and wood gnawing is that these parameters are not stable traits of individual animals. Table 4 shows that the amounts of wood gnawed by individual mice in test 1 and 2 were not strongly correlated. This also holds for the various aspects measured in the open-field test. In this light, it is not surprising that in individual mice wood gnawing and open-field behaviour were not correlated.

Summary

The question was addressed whether in two strains of mice the amount chewed off supplied balsa wood is correlated with one of six measured aspects of open-field behaviour. For individual mice there were no significant correlations. This may either relate to a different nature of wood gnawing and open-field behaviour or to the observed low degree of stability of these behaviours in individual animals.

Sammandrag

Frågan studerades om mängden av bortgnagt balsa trä som erbjudits till två olika stammar av möss står i korrelation till en av sex mätta parameter i open-field beteende. På individuella möss fanns inga signifikanta förbindelser. Detta kan antingen bero på olika karaktärer mellan trägnagning och open-field beteende eller den lågt observerade stabilität av detta beteende på individuella djur.

Yhteenveto / K. Pelkonen

Tutkimuksessa pyrittiin selvittämään korreloiko balsapuun jyrsiminen kahdessa tutkitussa hiirikannassa jonkun avokenttäkäytöksen kuuden muuttujan kansaa. Yksilötasolla ei löytynyt merkitsevää korrelaatiota. Tämä voi olle liittyä joko siihen, että puun jyrsiminen ja avokenttäkäytos ovat luonteeltaan erilaisia käyttäytymistapoja, tai näiden käyttäytysmuotojen havaittuun heikkoon pysyvyyteen yksilötasolla.

References

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