Housing condition and nesting experience do not affect the Time to Integrate to Nest Test (TINT)

ML Rock* † AZ Karas‡, MS Gallo†, K Pritchett-Corning§¶ and BN Gaskill§#

† Tufts University Cummings School of Veterinary Medicine, 200 Westboro Road, North Grafton, MA, USA
‡ Department of Clinical Sciences, Tufts University Cummings School of Veterinary Medicine, 200 Westboro Road, North Grafton, MA, USA
§ Charles River, 251 Ballardvale Street, Wilmington, MA 01887, USA
* Purdue University, 625 Harrison St, West Lafayette, IN 47906, USA
¶ Harvard University, Cambridge, MA, USA
# Purdue University, 625 Harrison St, West Lafayette, IN 47906, USA
* Contact for correspondence and requests for reprints: meaganrock@gmail.com

Abstract

Managing and assessing well-being in laboratory mice (Mus musculus) is both challenging and necessary. Assessments intended to detect negative welfare states in mice are usually performed via observation of animals in the home cage, but a substantial amount of time and skill may be required to detect subtle behavioural changes. The Time to Integrate to Nest Test (TINT) is a simple, cageside assessment tool that identifies the presence or absence of a highly motivated normal behaviour in mice. The test is conducted by adding a small amount of new nesting material to a mouse cage. A positive outcome is achieved when this new material is integrated into the home nest within 10 min. This study examined whether housing condition or nesting experience affects TINT outcome. Single or group housing did not influence the TINT outcome, but a significant difference in latency to integration was found; singly housed mice took longer than group-housed mice to integrate TINT substrate. Mice which were raised naïve to nesting material had no significant delays when tested. However, experience with the TINT procedure showed increased speed to incorporate the testing substrate, indicating that previous experience to the paradigm prior to experimental testing may be necessary. These findings help to define the expected outcomes of the TINT, better positioning it for use as an assessment tool in varied research settings.

Keywords: animal welfare, behaviour, husbandry, mice, nest building, stress

Introduction

Although they are the most commonly used mammals in biomedical research today, recognition and management of well-being in mice (Mus musculus) has lagged behind that of other species such as primates and canines. Assessment challenges include their typical prey species’ stoicism, nocturnal activity period, small size, and a lack of understanding as to what constitutes normal behaviour (Flecknell 1994; Hawkins 2002; Stasiak et al 2003; Matsumiya et al 2012). The Time to Integrate to Nest Test (TINT) is an assessment tool developed to provide people who work with mice with a simple and effective way by which to measure behavioural homeostasis and, by extension, well-being (Rock et al 2014). The TINT is based on the principle that nest building is a highly motivated behaviour demonstrated by all strains of laboratory mice (Latham & Mason 2004; Rock et al 2014). It is because of this high level of motivation that, when presented with a novel piece of nesting substrate, mice will collect and integrate that nesting substrate into their home nest within 10 min (Rock et al 2014) resulting in a positive TINT outcome. Failure to perform this behaviour within 10 min should be considered abnormal for most group-housed, inbred mice, generating a negative TINT outcome. This should trigger further examination of the mice. To ensure that this assessment tool is useful across a wider variety of laboratory conditions, we have tested its applicability in singly housed mice and in mice that are naïve to nesting material. We also tested two different, commonly utilised nesting substrates to determine how different materials would affect the TINT.

Single housing of mice is a common practice in the United States, despite the fact that mice are a social species. As such, housing them singly should be “justified on experimental requirements or veterinary related concerns about animal well-being” (National Research Council 2011). We know that social housing influences the stress response of mice and is linked to a decrease in post-operative recovery and stress (Pham et al 2010). Single housing is still commonly utilised during post-operative recovery periods, however, to provide investigators with the ability to directly monitor individuals, or when animals have implants that might be damaged by conspecifics. Housing conditions are known to affect the outcome of assessment tools that are behaviourally based (Ader et al 1991; Sherwin 2003; Spani et al 2003; Van Loo...