Maternal Care and Estrous Cycle Effects on Locomotor Activity in the Rat

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Introduction

Previous research has shown that male offspring of providers of high levels of maternal care as assessed by licking/grooming (LG) exhibit decreased stress reactivity relative to offspring of low LG providers (1). Low LG male offspring also show greater locomotion on the open field test (2). Locomotor behavior varies across the rodent estrous cycle, with an increase in generalized activity and a decrease in anxiety-related behaviors during proestrus relative to metestrus/diestrus. This variability is thought to result from fluctuations in progesterone and estradiol levels, which peak during proestrus and are lowest during metestrus/diestrus (3). Fluctuation in these hormone levels has also been linked to depressive-like behavior in the rodent (4).

Hypothesis

High LG female offspring will display decreased anxiety- and depressive-like behaviors relative to Low LG animals. Low LG female offspring will show greater variability in behaviors across the estrous cycle, reflecting greater fluctuations in steroid hormone levels.

Methods

Maternal LG scores were assessed (Fig. 1) by observing maternal behavior for the first six days post-partum, five times a day for 72 min.

Locomotor Activity

Adult Low (n=11) and High (n=11) LG female offspring were habituated to a locomotor activity box over three days. Activity was recorded during one hour periods while each animal was in proestrus, estrus, and metestrus/diestrus and scored using VersaMax software. Behaviors analyzed included time spent engaging in horizontal activity, rearing behavior, and scored using days. Activity was recorded during one hour periods while each offspring were habituated to a locomotor activity box over three days. Locomotor Behavior is thought to result from fluctuations in progesterone and estradiol levels, which peak during proestrus and are lowest during metestrus/diestrus (3). Fluctuation in these hormone levels has also been linked to depressive-like behavior in the rodent (4).

Locomotion on the open field test (2).

High LG female offspring are less anxious than Low LG female offspring, particularly when progesterone levels are highest (Fig. 2).

• High LG female offspring show a greater amount of rearing behavior, particularly when steroid hormones are at their lowest (Fig. 3).
• Animals display decreased depressive-like behavior when steroid hormone levels are highest.
• High LG offspring are more vulnerable to development of “behavioral despair”.
• Natural variations in hormone levels produce unique patterns of affective behaviors across the estrous cycle.

Future Directions

• Brains will be examined for the quantity of progesterone receptors and estrogen receptor alpha and beta in regions implicated in both anxiety and depression.
• Mood will be characterized further with additional behavioral tests.

References