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A place preference test in the fish Nile tilapia

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Abstract

The Nile tilapia fish (*Oreochromis niloticus*) has a high potential to be used as a model in neuroscience studies. In the present study, the preference of the Nile tilapia between a gravel-enriched (GEE), a shelter-enriched (SEE) or a non-enriched (NEE) environment was determined, for developing a place preference model. Nile tilapia had an initial preference for GEE, but after 1 day of observation, the fish stabilized their frequency of visits among compartments. Hence, any stimulus motivating tilapia increase in compartment visiting indicates a positively reinforcing effect. This feature is very useful for the development of new behavioural paradigms for fish in tests using environmental discrimination, such as the conditioning place preference test.

Keywords: Conditioning place preference; Behaviour; *Oreochromis niloticus*; Nile tilapia; Fish

Introduction

In neuroscience, some studies of reinforcement and learning processes use methodological procedures that include environmental discriminations (Serra et al., 1999). Accordingly, we may highlight the conditioning place preference test, which is

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usually used to determine the reinforcing effects of drugs (Hasenohrl et al., 1989). Commonly, this place-preference test paradigm uses two compartments as choice possibilities (Coelho et al., 2001), where the animal has to associate a specific place with a stimulus. An increase in the time spent in a specific environment during preference test indicates a positively reinforcing stimulus effect (Hasenohrl et al., 1989; Mattioli et al., 1998; Coelho et al., 2001). However, an animal may spend more time in a compartment than in another, in a specific environment, because it is feeling safe instead of having positively reinforcing effect (Serra et al., 1999). Therefore, to know a natural preference for one out of the other compartments is very important to avoid wrong interpretations of the results.

The conditioning place preference test has been largely applied in experiments that use mammalian models, since they are considered awareness animals (Griffin and Speck, 2004). Nevertheless, other animals may be considered aware to take choices of action they likely get what they want, or avoid what they dislike, suffer or fear, such as fish (Chandroo et al., 2004; Conte, 2004). In this way, recently, the conditioning place preference model has been successfully applied to fish (for example, see Mattioli et al., 1998; Medalha et al., 2000; Coelho et al., 2001; Darland and Dowling, 2001; Faganello et al., 2003). However, these studies focusing on fish, as far as we know, comprise only two fish species: the goldfish (*Carassius auratus*), and the zebrafish (*Danio rerio*). Fish represents one of the most diverse taxon of vertebrates (Pough et al., 2001), living in a wide variety of habitats. Consequently, this variety of species and environmental locations is a source of biological matter useful in different areas of biological research, including neuroscience and behaviour (Bolis et al., 2001). According to above statements, the advantage of the animal model is represented by the fact that a peculiar intraspecific characteristic makes them especially useful for addressing specific questions. Thus, we consider Nile tilapia a good candidate as a model to elaborate a place preference test due to some special features of them as pointed out below.

This species is a territorial fish that builds nests on gravel during reproduction (Gonçalves-de-Freitas and Nishida, 1998; Barreto et al., 2003b; Volpato et al., 2004) and they may use shelters as territories, contributing, for instance, to protect themselves against predator attacks by hiding (Kolding, 1993). Hence, both gravel and shelter are important resources for Nile tilapia life. Thus, in the present study, the preference of the Nile tilapia fish (*Oreochromis niloticus*) between a gravel-enriched (GEE) or a shelter-enriched (SEE) environment was tested, for developing a place preference model. Our test faces an environment that offers protection for the fish with one another representing an essential resource for their reproduction. Thus, this test model allows us to distinguish Nile tilapia preference between two important resources for them. Moreover, Nile tilapia fish were chosen because it is easy to maintain, in fact it is the most cultured cichlid of the world, and it has been used in studies addressing some themes of neuroscience and behaviour, such as stress (Volpato and Barreto, 2001; Corrêa et al., 2003; Barreto and Volpato, 2004; Moreira and Volpato, 2004); anxiety, emotionality and/or defence (Ide and Hoffmann, 2002; Barreto et al., 2003a); and drugs affecting feeding behaviour (Delicio and Vicentini-Paulino, 1993).