Early exposure to ethanol but not red wine at the same alcohol concentration induces behavioral and brain neurotrophin alterations in young and adult mice

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1. Introduction

Several lines of evidence indicate that ethanol exposure during prenatal or postnatal life can influence cell proliferation and differentiation in the central nervous system (CNS) causing severe neurotoxicity and inducing in humans Fetal Alcohol Syndrome (FAS) and Fetal Alcohol Spectrum Disorders (FASD) (Niccols, 2007; Abel, 2006; Mancinelli et al., 2007). These are disorders of permanent birth defects occurring in the offspring of women drinking ethanol during pregnancy. Ethanol may cross the placental barrier and can stunt fetal growth or weight. The main effect of fetal alcohol syndrome is permanent CNS damage, especially the brain. Developing brain cells and structures are underdeveloped or malformed by prenatal ethanol exposure, often creating an array of primary cognitive and functional disabilities (including poor memory, attention deficits, impulsive behavior, and poor cause–effect reasoning) as well as secondary disabilities (for example, mental health problems, and drug addiction) (Abel, 2006). Fetal alcohol exposure is a leading cause of mental retardation in western countries with medical and social costs extremely high (Abel and Sokol, 1987; Bloss, 1994). The cellular, biochemical and molecular mechanisms implicated in these deleterious actions of ethanol are not fully known. Reported studies led to the hypothesis that ethanol consumption by the mother can affect brain regions inducing neuronal cell death in the offspring (Servais et al., 2007). Prenatal ethanol may also affect biological mediators, including growth factors synthesis and release by cells of the CNS (Goodlett et al., 2005). If ethanol is administered during pregnancy it may impair irreversibly the neurotrophin signaling pathways (Aloe, 2006; Moore et al., 2004). Nerve growth factor (NGF) and brain derived neurotrophic factor (BDNF) play a role in the response to ethanol administration (Miller and Mooney, 2004; Heaton et al., 2003) as shown in animal models. They are members of the family of proteins known as neurotrophins, including neurotrophin-3 (NT-3), and NT-4/5. NGF and BDNF are the most thoroughly studied neurotrophic factors, playing a crucial role in the survival and development of specific peripheral and brain neurons (Chao et al., 2006; Allen and...