

Acoustic Characteristics of Ultrasonic Vocalizations in Rat Pups Prenatally Exposed to Ethanol

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Abstract : Prenatal ethanol exposure has potential to induce difficulties in the social behavior of rats and can alter pup-dam communication suggesting that deficits in pups could result in altered dam behavior, which in turn could result in more aberrant behavior in the pup. Ultrasonic vocalization (USV) is a sensitive tool for investigating social behavior between rat pups and their dam. Rat pups produce USVs on separation from their dam. This signals the dam to locate her pups and retrieve them back to the nest. In this study, it was predicted that prenatal ethanol exposure cause alterations on the acoustic characteristics of USVs in rat pups. Thirteen pregnant rats were purchased and randomly assigned into three groups: high-ethanol (n = 4), low-ethanol (n = 5), and control (n = 4) groups. Laboratory ethanol (purity = 99.5%) was dissolved in tap water and administered to the high- and low-ethanol groups as drinking water from gestational days (GD) 8-20. Ethanol-containing water was administered to the animals in three stages by gradually increasing the concentration between GDs 8-20. From GDs 8-10, 10% and 5%, from GDs 11-13, 20% and 10%, and from GDs 14-20, 30% and 15% ethanol-containing water (v/v) was administered to the high- and low-ethanol groups, respectively. Tap water without ethanol was given to the control group throughout the experiment. The day of birth of the pups was designated as postnatal day (PND) 0. On PND 4, each litter was culled to four male and four female pups. For the present study, two male and two female pups were randomly sampled from each litter as subjects. Thus, eight male and eight female pups from the high-ethanol and control groups and another 10 male and 10 female pups from the low-ethanol group, were sampled. An ultrasonic microphone and the Sonotrack system version 2.4.0 (Metris, Hoofddorp, The Netherlands) were used to record and analyze USVs of the pups. On postnatal days 4, 8, 12 and 16, the resultant pups were individually isolated from their dams and littermates, and USVs were recorded for 5 min in a sound-proof box. Pups in the high-ethanol group produced greater number of USVs compared with that in both low-ethanol and control groups on PND 12. Rat pups in the high-ethanol group also produced higher mean, minimum, and maximum fundamental frequencies of USVs compared with that in both low-ethanol and control groups. Male pups in the high-ethanol group had higher USV amplitudes than in those in low-ethanol and control groups on PND 12. These results suggest that pups in the high-ethanol group relatively experienced more negative emotionality due to the ethanol-induced neuronal activation in the core limbic system and tegmental structures and accordingly, produced altered USVs as distress calls.

Keywords : emotionality, ethanol, maternal separation, ultrasonic vocalization

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