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Abstract

The Prenatal Bisphenol A Exposure Effects on Neural Signaling Activity in Male Rat Hippocampus and Its Neurobehavioral Outcomes †

Norazirah Mat Nayan [1,2], Andrean Husin [3,4], Siti Hamimah Sheikh Abd Kadir [5] and Rosfaiizah Siran [1,4,*]

[1] Centre for Neuroscience Research (NeuRon) Faculty of Medicine, Universiti Teknologi MARA, Sungai Buloh, Selangor 47000, Malaysia; azirahnayan@gmail.com
[2] Laboratory Animal Care Unit (LACU), Universiti Teknologi MARA, Sungai Buloh, Selangor 47000, Malaysia
[3] Faculty of Dentistry, Universiti Teknologi MARA, Sungai Buloh, Selangor 47000, Malaysia; andrean@uitm.edu.my
[4] Neuroscience Research Group (NRG), Faculty of Medicine, Universiti Teknologi MARA, Sungai Buloh, Selangor 47000, Malaysia
[5] Institute of Molecular Medicine (IMMB) Faculty of Medicine, Universiti Teknologi MARA, Sungai Buloh, Selangor 47000, Malaysia; sitih587@uitm.edu.my
* Correspondence: rosfaiizah@uitm.edu.my
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Abstract: Bisphenol A (BPA) is an organic synthetic compound that is most publicized as an endocrine-disrupting chemical (EDCs) due to its remarkable effects on signaling activity via multiple steroid hormone receptors. The environmental perturbations on signaling networks such as BPA during the prenatal period may be involved in developmental disorders by anti-androgenic effects, especially on neurodevelopment leading to memory and behavior deficits when reaching adulthood. The objective of the present study is to determine the effects of prenatal BPA exposure on the relationship of synaptic plasticity markers (Synapsin I and PSD 95) with N-Methyl-D-Aspartate receptor (NMDAR) subunits (GRIN2A and GRIN2B) in neural communication networks and its neurobehavioral outcomes. Pregnant Sprague Dawley rats were orally dosed at 5 and 50 mg/kg/day with 0.5% Tween 80 in reverse osmosis water from gestational day 2 until 21 or until spontaneous delivery. The control group was exposed to the same treatment except without BPA. The male litters were raised until postnatal day 35 (PND35). At PND35, the competency of rats in learning and memory tasks was evaluated by open field, step-down passive avoidance and Morris water maze tests for six consecutive days and followed by quantification of GRIN2A, GRIN2B, PSD95 and Synapsin I using ELISA. The data obtained from the respective days show prenatal BPA exposure significantly induced anxiety-related behavior and impairment in spatial memory at the dosage BPA-treated group compared to the control group. Additionally, utero BPA exposure also significantly downregulated the expression of GRIN2A ($p = 0.000$), GRIN2B ($p = 0.001$) and PSD95 ($p = 0.004$) in the adult male rat hippocampus. These data suggest that the impairment in neurobehavioral performance might be involved with the inhibition of signaling pathways between synaptic plasticity markers and NMDAR subunits in the adult male rat hippocampus, leading to learning and memory deficits when reaching adulthood.

Keywords: Bisphenol A; signaling activity; synaptic plasticity markers; NMDAR subunits; neurobehavioral

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