Exposure to artificial food colors and additives (AFCAs) has been implicated in the induction and severity of some childhood behavioral and learning disabilities. N-methyl-D-aspartate receptors (NMDARs) and nicotinic acetylcholine receptors (nACHRs) are thought to be effective in the learning and memory-generating process. In this study, we investigated the effects of intrauterine exposure to AFCAs on subunit concentrations of NMDARs and nACHRs isoforms in rats. We administered a mixture of AFCAs (Eritrosin, Ponceau 4R, Allura Red AC, Sunset Yellow FCF, Tartrazin, Amaranth, Brilliant Blue, Azorubin and Indigotin) to female rats before and during gestation. The concentration of NR2A and NR2B subunits and nAChR α7, α4β2 isoforms in their offspring's hippocampi were measured by Western Blotting. Expressions of NR2B and nAChR β2 were significantly increased (17% and 6.70%, respectively), whereas expression of nAChR α4 was significantly decreased (5.67%) in male experimental group compared to the male control group (p<0.05). In the female experimental group, AFCAs caused a 14% decrease in NR2B expression when compared to the female control group (p<0.05). Our results indicate that exposure to AFCAs during the fetal period may lead to alterations in expressions of NMDARs and nAChRs in adulthood. These alterations were different between male and female genders.