

NICOTINE EXPOSURE DURING BREASTFEEDING ALTERS CARDIAC PARAMETERS IN MALE AND FEMALE OFFSPRING

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Abstract

Nicotine is one of the main psychoactive and toxic substances found in tobacco and its exposure during the postnatal period can cause several damages to the health of the child during intrauterine development and in adult life. The aim of this study was to evaluate the effect of maternal postnatal nicotine exposure on cardiac parameters in adult rat offspring. Weight monitoring, echocardiography and organ collections were performed. In conclusion, offspring from mothers exposed to nicotine develops cardiac hypertrophy, further male offspring were more affected.

Keywords: DOHaD, Lactation, Cardiac Hypertrophy

1. Introduction

Last years has marked the concern of specialized health agencies with the smoking epidemic, a chronic disease motivated by exposure and chemical dependence of people to nicotine [1, 2, 3, 4]. Some chemically dependent women stop using tobacco derivatives during pregnancy. However, most of them do not take into account, that even during the suckling phase, the use of these derivatives can interfere with the metabolism and, consequently, with the health of your child [5, 6]. The presence of cotinine (main nicotine metabolite) has been observed in the breast milk of female rats exposed to nicotine during lactation [7]. The nicotine, when associated with a high-fat diet, promotes a significant increase in apoptosis in



cardiomyocytes [8]. Furthermore, it has observed blood pressure increases in rats and humans exposed to nicotine [9, 10, 11]. The present study evaluated the effect of postnatal nicotine exposure on cardiac parameters in male and female rat offspring at adulthood.

2. Material and Methods

Pregnant Wistar rats were divided into two experimental groups. Control group (CON) and Nicotine group (NIC). After the birth of the pups, NIC mothers were anesthetized with Ketamine (100 mg/Kg) and Xylazine (5 mg/Kg, i.p.) and submitted to the implantation of osmotic mini-pumps containing nicotine (6 mg/kg/day), for 14 days. CON mothers were submitted to the implantation of osmotic mini-pumps containing saline.

The litter were standardized into four male and four female offspring throughout lactation period. At 180-day-old, a batch of the offspring was anesthetized (Ketamine 100 mg/Kg and Xylazine 5 mg/Kg, i.p.) to perform the echocardiography measurements. After, the offspring were euthanized to sample collection. Student's t test was used for the analysis of time independent parameters and two-way ANOVA for analysis of time-dependent parameters.

3. Results e discussion

Male NIC offspring were heavier and had increased retroperitoneal fat (CON 3.972 ± 0.38 g vs NIC 5.378 ± 0.56 g) compared to male CON offspring. However, there was no difference in body weight or adiposity between the female offspring. The 180-day-old offspring also exposed to nicotine during lactation, developed obesity and higher visceral fat content [12]. Male (CON 223.1 ± 5.36 bpm vs CIN 259.0 ± 12.7 bpm) and female (CON 211.1 ± 7.2 bpm vs CIN 246.5 ± 7.2 bpm) offspring NIC offspring had a higher heart rate. In the present study, there was a difference in heart rate for both genders, since acute and combined exposure to nicotine generated changes in heart rate, such as short-term bradycardia events and tachycardia sessions, in addition to high blood pressure levels [13]. Only the interventricular septum increased during systole in male NIC offspring (CON 0.1951 ± 0.003 cm vs NIC 0.2224 ± 0.008



cm). Enlargement of the interventricular septum may be related to the type of concentric hypertrophy.

Heart height (CON 1.046 ± 0.02 g vs NIC 1.312 ± 0.04 g) and heart height - tibia length ratio (CON 0.2594 ± 0.006 g/cm vs NIC 0.2994 ± 0.010 g/cm) were increased in male NIC offspring in comparison with CON offspring. Female NIC offspring also show increased heart height (CON 0.7293 ± 0.01 g vs NIC 0.7994 ± 0.02 g) and (CON 0.1941 ± 0.004 g/cm vs NIC 0.2111 ± 0.006 g/cm) heart height - tibia length ratio in relation to CON offspring. In another study, the authors showed that rat offspring exposed to nicotine during pregnancy and lactation, shows decreased in the heart/body weight ratio in the first 7 days after birth. However, with 7 and 21 days after birth, the pups showed cardiac hypertrophy due to the increase of cardiomyocytes and collagen, but without alteration in the mass [14]. New investigations should be carried out to assess whether NIC puppies have histological changes, such as cardiomyocyte hypertrophy and increased collagen deposition. In addition, it is also important to assess which mechanisms may be involved with such changes.

4. Conclusion:

The results suggest that male NIC offspring were the most affected by nicotine exposure during lactation, leading to higher body weight and obese phenotype. In addition, male and female NIC groups both presented high heart rate and cardiac hypertrophy.

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