Background: There is consistent evidence to relate maternal harmful lifestyle such as smoking cigarettes, drink alcohol or abuse drugs to increased risk of intrauterine growth retardation, however, the definite mechanisms governing pregnancy smoking exposure and IUGR risk are still keep unclear. In another side, it is quite necessary and important to establish a safe, convenient, specific and early diagnostic procedure for IUGR due to the inherent defects of the present diagnostic methods.

Methods: Pregnant Wistar rats were intragastric administered with different doses of nicotine (0.5, 1.0 and 2.0 mg/kg) daily from gestational day (GD) 11. At GD20, all the samples including fetal plasma, amniotic fluid and maternal plasma were collected. The other pregnant rats as those described above were subject to 2.0 mg/kg of nicotine daily gavages from GD9, the samples of maternal plasma were collected at GD11, GD14, GD17 and GD20, respectively. NMR-based metabonomics approaches in combination with multivariate statistical analysis have been used to analyze the metabolic responses of those biofluids to nicotine-induced dose- and time-dependent effects in order to demonstrate alteration of intrauterine metabolism and to identify the potential biomarkers in maternal blood served to early diagnosis of IUGR.

Results and discussion: The IUGR rates of fetuses in nicotine-treated groups were significantly augmented compared with that in control group. The wealth of information from metabonomics analysis has revealed different metabolic profiling in the respective pathophysiological regime including maternal plasma, fetal plasma and amniotic fluids (Figs. 1 & 2). The metabolic changes due to nicotine-administration involved abnormal glucose, lipid and protein metabolisms which were characterized by the variations in concentrations of a collection of metabolites in fetal and maternal plasma and amniotic fluid of IUGR (Fig. 3). Further, some metabolites were selected from maternal plasma as biomarker candidates served to the diagnosis of nicotine-induced IUGR.

Conclusions: NMR-based metabolomics appears as a promising approach for distinguishing the development of IUGR, and a collection of candidate biomarkers in maternal plasma are identified for the diagnosis of early IUGR. And further, such information could be served to prevention and therapy of IUGR in the clinical practice.

References