

Oxidative stress markers in relation to circulating adiponectin and visfatin levels in neonates exposed and non-exposed in utero on tobacco smoke

Chelchowska M, Ambroszkiewicz J, Gajewska J, Rowicka G, Maciejewski TM, Mazur J
Institute of Mother and Child, Warsaw, Poland

Objective

Oxidative stress (OS) has been associated with numerous adverse pregnancy outcomes and fetal disturbances. Due to overproduction of reactive oxygen (ROS) and reactive nitrogen species (RNS) as well as inadequate induce of antioxidant protection newborns are particularly susceptible to oxidative injury. Furthermore, it has been shown that oxidative stress in adipose tissue may also impairs neonatal condition in consequence to disrupted adipokines expression. Adipokines are bioactive molecules expressed and secreted mainly from adipose tissue playing critical roles in energy homeostasis and are regarded to be key regulators of insulin sensitivity. Moreover, adipokines are constitutively expressed by the fetoplacental unit and are present in cord blood suggesting an involvement of these molecules in fetal development. Maternal smoking is considered as a source of oxidative stress, therefore we examined the relationship between markers of oxidative stress/antioxidant defense and selected adipokines in the umbilical cord of neonates exposed and non-exposed in utero to tobacco smoke.

Methods

Cord blood samples were obtained from 86 healthy women at delivery following a pregnancy of 37-42 weeks, patients of Institute of Mother and Child in Warsaw, Poland. The study included a consecutive series of 41 active smokers who smoked minimum 5 cigarettes per day throughout their pregnancy and smoked minimum 2 years before conception, and a series of 45 non-smokers of similar age and age of gestation, who had never smoked and were not exposed to environmental tobacco smoke during their pregnancy (smoking spouse or co-workers). The measured parameters were oxidized low density lipoprotein (ox-LDL), total oxidant capacity (TOC) and total antioxidant capacity (TAC), adiponectin and visfatin. The statistical analyses were performed using SPSS statistical software version 17. 1.

Results

Birth weights and body length of the smokers' newborns were found to be lower than those of non-smokers', however, in the case of length, there were no statistical differences. According to biochemical markers, the newborns of smoking mothers had significantly higher concentrations of serum visfatin, ox-LDL, TOC, and OSI ($p < 0.001$), but lower adiponectin and TAC levels ($p < 0.001$, $p < 0.05$ respectively) compared with newborns of non-smoking women. In whole group of children (adjusted for smoking status, gender and birth weight) adiponectin showed negative and visfatin positive correlations with ox-LDL. In the model estimated separately for smokers (adjusted for child gender, birth weight and number of cigarettes/day) ox-LDL explained 36% of adiponectin and 35, 5% of visfatin variance, while in the model of non-smokers (adjusted for child gender and birth weight) 36, 8% and 69, 4% respectively.

Conclusion

Maternal smoking enhances oxidative status and depletes antioxidant potential in newborns. Lower level of adiponectin and higher visfatin concentration seems to be related with a less beneficial oxidative stress profile and higher level of lipid peroxidation in neonates exposed and non-exposed in utero to tobacco smoke.

Table 1. Clinical characteristics and biochemical measurements of the study subjects (N=85)

	Non-smoking group N=44	Smoking group N=41	p-value
<i>Newborn</i>			
Male/Female (%)	56.8/43.2	53.7/46.3	0.470
Gestational age (week)	39 (39-40)	39 (38.5-40)	0.086
Apgar score (5 th min)	10 (10-10)	10 (10-10)	0.146
Birth weight (g)	3511.4 ± 426.4	3123.7 ± 431.3	0.000
Birth length (cm)	55.6 ± 2.7	54.4 ± 2.8	0.058
Adiponectin (µg/mL)	21.8 ± 7.4	18.6 ± 4.8	0.019
Visfatin (ng/mL)	9.0 ± 2.3	14.4 ± 3.5	0.000
Ox-LDL (ng/mL)	71.7 ± 25.4	108.9 ± 41.1	0.000
TOC (mmol/L)	0.195 ± 0.102	0.352 ± 0.164	0.000
TAC (mmol/L)	1.694 ± 0.382	1.189 ± 0.277	0.000
OSI	0.128 ± 0.080	0.323 ± 0.195	0.000
Cotinine (µg/L)	0	81.5 ± 29.3	-
<i>Mother</i>			
Age (years)	28.9 ± 4.7	28.2 ± 4.4	0.465
Maternal weight (kg)	64.8 ± 5.5	63.8 ± 5.2	0.398
Maternal height (cm)	164.6 ± 4.5	165.1 ± 4.9	0.651
Pre-gravid BMI (kg/m ²)	23.9 ± 1.4	23.4 ± 1.43	0.095
Number of cigarettes/day	0	10 [5 - 10]	-
Time of smoking before conception (year)	0	8 [5 - 12]	-

^aValues are means ± standard deviation (SD), ^bValues are median and interquartile range (25th-75th percentiles), ^cValues are percentage, Ox-LDL oxidized low-density lipoprotein, TOC total oxidant capacity, TAC total oxidant capacity, OSI oxidative stress index, BMI body mass index;

Table 2. The correlations between adipokines (adiponectin, visfatin) and oxidative stress parameters in newborns of non-smoking and smoking mothers group

	Adiponectin		Visfatin	
	<i>r</i>	<i>p</i> -value	<i>r</i>	<i>p</i> -value
Non-smoking (n=44)				
Ox-LDL	-0.607	0.000	0.833	0.000
TOC	-0.492	0.001	0.553	0.000
TAC	0.453	0.002	-0.585	0.000
OSI	-0.500	0.001	0.579	0.000
Smoking (n=41)				
Ox-LDL	-0.600	0.000	0.596	0.000
TOC	-0.334	0.033	0.242	0.127
TAC	0.268	0.091	-0.060	0.710
OSI	-0.344	0.033	0.243	0.125

Ox-LDL oxidized low-density lipoprotein, *TOC* total oxidant capacity, *TAC* total oxidant capacity, *OSI* oxidative stress index