Letter to the Editor

The level of ascorbic acid in the amniotic fluid of smoking and non-smoking women in labour

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Dear Editor,

We would like to report our recent findings that point to remarkable differences in the levels of soluble proteins and ascorbic acid measured in amniotic fluid, which can be associated with the smoking habits of the mother.

Embryonic and foetal growth in mammals depends on the flow of nutrients and oxygen from the mother. All soluble organic and inorganic matter is transferred from the mother to the foetus through the placental barrier, which includes compounds from various harmful sources. One such source is tobacco smoke, a mixture of over 5,000 different inorganic and organic compounds, many of which are carcinogenic (1-3). Children of smoking mothers commonly experience deleterious health effects.

Reactive oxygen species (ROS) are an important source of damage to biologically important macromolecules like DNA, proteins, lipids and polysaccharides. They can have either exogenous or endogenous origin, the latter including intracellular sources, e.g. mitochondria (4). Each organism counteracts harmful ROS-mediated effects through various antioxidant molecules, among which are vitamins C and E, albumin, haemoglobin, uric acid, and enzymes such as catalase or superoxide dismutase (5). Considerable amounts of antioxidants originate from one’s diet, if it is rich in fruit and vegetables.

A large influx of ROS leads to oxidative stress, which creates a microenvironment prone to pathogenic processes (6). Every cigarette one smokes induces a certain level of oxidative stress (7). The aforementioned vitamin C (or ascorbic acid) has been confirmed as an effective neutralizer of ROS, as it releases hydrogen atoms and transforms into dehydroascorbic acid (4). Smokers exhibit as many as three-fold lower vitamin C levels in plasma than non-smokers (8).

In a pilot study we conducted within our own institutions, we examined the level of soluble proteins and ascorbic acid in the amniotic fluid of twenty smoking and non-smoking women in labour. Nine of the mothers were non-smokers, 4 occasional smokers, and 7 permanent smokers. Occasional smokers smoked 4-10 cigarettes per day and stopped smoking once they had become aware of their pregnancies. The permanent smokers had smoked up to 15 cigarettes a day until they became aware of their pregnancies and then reduced that number to 2-4 cigarettes per day.

Applying standard methodology (9, 10), the amniotic fluid samples were prepared for protein analysis and colorimetric measurement of vitamin C levels. The obtained results (see Table 1) were expressed in µg ascorbic acid per mL of amniotic fluid.

The differences in the quantities of ascorbic acid were even greater. The highest quantity was recorded in non-smoking mothers, while the other two groups exhibited 6 to 7 times lower values.

The ascorbic acid values we observed in the smoking mothers deserve particular attention, as a deficiency of ascorbic acid may have a detrimental effect on foetal growth and development and pose a potential risk. It should also be mentioned that the concentration of ascorbic acid in amniotic fluid may vary considerably in long-lasting childbirths due to additional stress.

The decrease of ascorbic acid in amniotic fluid was associated with the decrease in protein quantity, which was possibly influenced by diminished protein synthesis in the foetal metabolism. It is also quite possible that low levels of vitamin C may lead to the impaired physiological functioning of a developing organism (11, 12).
Table 1: Concentration of soluble proteins and ascorbic acid in the amniotic fluid taken from non-smoking, occasionally smoking, and permanently smoking women in labour.

<table>
<thead>
<tr>
<th>Group</th>
<th>Amniotic fluid</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Proteins</td>
<td>Ascorbic acid</td>
<td></td>
</tr>
<tr>
<td></td>
<td>mg mL⁻¹</td>
<td>µg mL⁻¹</td>
<td></td>
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<tr>
<td>Non-smokers</td>
<td>2.04±0.01</td>
<td>574.20±59.22</td>
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<tr>
<td>Occasional smokers</td>
<td>2.03±0.02</td>
<td>83.21±8.89</td>
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<tr>
<td>Permanent smokers</td>
<td>1.09±0.04*</td>
<td>91.55±9.89*</td>
<td></td>
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</tbody>
</table>

*p<0.001 with regard to non-smoking
**=p<0.001 with regard to occasional smokers

Our preliminary results suggest that macromolecular analysis of amniotic fluid could point to the harmful effect that tobacco smoke has on foetal growth.

REFERENCES