# Caesarean section changes the gut colonization of the newborn – a link to disease risk?

Delivery by means of caesarean section is a shared risk factor for several immune-mediated diseases in childhood, including asthma. The healthy embryo is believed to be sterile, receiving the first bacteria from mother´s birth canal and intestinal tract during natural delivery. When delivered by caesarian section instead, the very first microbes colonizing the child are obtained from contact with the hospital environment and mother´s skin. The diversity of the human microbiome - the community of microorganisms that literally share our body space - is in fact set in early life and it has been suggested that the composition of the gut bacterial community might affect the maturation of the infant immune system. In turn, an inadequate composition might lead to chronic inflammatory diseases such as asthma and allergy. This suggests that the early bacterial composition of the newborn is an important factor for a healthy development, as the mode of delivery might determine which microbes colonize and inhabit our human body.

In order to determine the effect of delivery mode, including different types of caesarian sections, on the colonization patterns of the gut and airways, we analyzed the samples from 700 children during the 1st year of life. The children participate in the ongoing Copenhagen Prospective Studies on Asthma in Childhood$_{2010}$ (COPSAC$_{2010}$) birth cohort, and had fecal and airways samples taken at three different time points to follow the bacterial development until age one. These samples were all characterized by traditional culturing methods and we examined bacterial differences between children born naturally and by caesarean section, and furthermore between children, who were born either by emergency or elective caesarean section. The difference between the two latter lies in the fact that emergency caesarian section generally happens after water broke and the birth process has started.

In our study, 78% of the children were born by natural delivery, 12% by emergency and 9% by elective caesarean section. We could demonstrate major bacterial differences in the gut composition between naturally delivered children compared to children delivered by caesarean section. We could also see differences between types of caesarean section. These differences were most obvious at 1 week of age, lesser at 1 month while they had disappeared when the children turned one year. The initial bacterial colonization of the airways was largely unaffected by the birth mode.

Overall we found that delivery by caesarean section was associated with changes in the early bacterial composition of the newborn’s gut but not in the airways. Very interestingly, the observed differences were all leveled at 1 year of age pointing toward a possible time window of importance in laying the path towards health or disease later in life. Others have shown that the use of antibiotics in conjunction with delivery, which is common practice, likewise affects the bacterial gut composition up to one year of age. It is possible that inadequate or deranged bacterial composition in early life might represent a link between delivery by means of caesarian section and immune-

mediated disease. If this is the case, our findings may lay the groundwork for future microbial manipulation, such as probiotics or bacterial inoculation, of newborn babies.

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## Publication

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