Metabolic imbalance increases risk of respiratory diseases in childhood

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The metabolism influences the manifestation of respiratory diseases. This was shown in analyses involving newborns and infants conducted as part of the large-scale mother-child study (LiNA), following the medical and environmental development of more than 620 children until they turned 18. Credit: André Künzelmann, UFZ

An imbalance in our metabolism can trigger inflammatory processes in the body and activate the immune system. In a recent study, published in

the *Journal of Allergy and Clinical Immunology*, UFZ researchers have been able to show that this applies even to newborns and children under one year of age, and is correlated with the development of respiratory diseases in early childhood.

If pathogenic agents penetrate our body, our immune system is put on high alert. The body reacts with inflammatory processes, initiating a whole series of defence mechanisms - with the aim of quickly and effectively incapacitating the undesirable intruders. However, on occasion, an alteration in metabolic balance can be the trigger for an inflammatory immune response. In such cases, forces are mobilised to combat an enemy that does not actually exist.

"We wanted to find out whether this phenomenon is present among newborns and children under one year of age," says UFZ Researcher Dr. Gunda Herberth. Her study published in the *Journal of Allergy and Clinical Immunology* is part of the so-called "LiNA Study", which examines sensitive phases of a child's development with a focus on lifestyle, environmental factors and the subsequent appearance of allergies and respiratory diseases.

Dr. Herberth and her colleagues examined blood samples from newborns (cord blood) and children under one year of age for any possible correlation between metabolites and immune parameters – and made a discovery: Elevated concentrations of specific sugars - known as hexoses - in the blood were accompanied by elevated concentrations of inflammatory immune parameters. Conversely, a high concentration of other metabolites, such as protein components (amino acids) or degradation products of certain fats inhibited the development of inflammatory parameters.

"Increased concentrations of sugars in the blood therefore do actually lead to the development of an inflammatory immune response, even in

newborns. In turn, this is directly correlated with the development of respiratory diseases in early childhood," explains Dr. Herberth. In-vitro tests carried out by the researchers have confirmed the findings of her epidemiological investigation: In cell cultures, immune cells exposed to hexoses showed elevated concentrations of inflammatory parameters, while those exposed to amino acids inhibited the production of inflammatory components. Dr. Herberth commented: "As certain amino acids can obviously also provide protection from inflammation, we assume that the balance between the metabolites is primarily responsible for the development of inflammatory processes."

So in subsequent investigations, the UFZ researchers are aiming to determine the reason for this kind of change in the concentration of metabolites in the blood: "In addition to diet, environmental pollutants also undoubtedly play a decisive role," stated Dr. Herberth. "For example, we know that plasticisers can impair our metabolism. Precisely how and where they disrupt our metabolic pathways – and depending on the degree, with far-reaching consequences – will be the focus of our future research."

More information: "Endogenous metabolites and inflammasome activity in early childhood and links to respiratory diseases." DOI: dx.doi.org/10.1016/j.jaci.2015.01.022

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