DFG-SKLM Round table „Nitrate and nitrite in the diet- benefit/risk for human health"

Introduction and aims

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The Senate commission for food Safety of the DFG (SKLM) has organized this round table with the intention to discuss the present state of knowledge concerning potential risks versus benefits of nirate / nitrite in foods. The mean dietary nitrate uptake of adults is about 160 mg / d. This is well below the acceptable daily intake (ADI) of 222 mg /person deduced by the European Safety Authority (EFSA) [1]. People with high consumption of vegetables or vegetarians may, however, easily arrive at much higher nitrate intake, considerably exceeding the ADI. Some vegetables are especially rich in nitrate, such as spinach, rucola, beets, radish. Nitrate and nitrite also are added to meat and meat products for curing purposes. Under such conditions, nitrite can be formed from nitrate by the curing microflora.

In the mammalian organism, nitrate, nitrite and nitrogen oxides are metabolically interconvertible. Nitrogen monoxide is an important physiological signaling molecule generated from arginine by endothelial/ inducible NO-synthases (eNOS,iNOS). Bacterial infections as well as inflammation also may contribute significantly to the endogenous NO /NOx/ nitrite burden. Nitrogen monoxide (NO) is not an N-nitrosating agent per se, but may rapidly be converted into nitrosating/ oxidizing reactands such as NOx, peroxynitrite, nitrite and others. Although there is compelling evidence that endogenous formation of N-nitroso compounds (NOC) occurs in humans, the potential health risk resulting from such endogenous NOC exposure today still is not very well understood.

Recent results from experimental and human intervention studies as well as observations from epidemiology suggest beneficial health effects associated with dietary nitrate uptake. Special attention has been given to indications for decreased risks concerning cardiovascular disease or detrimental health effects associated with metabolic syndrome, but also to potential neuroprotective effects or to cytoprotection of tissues such as gastric mucosa [1-3].

The aim of the present round table is an analysis, based on present day knowledge, of health risks and benefits of nitrate/ nitrite. On one side, the focus is on means to reliably assess the potential human health risk posed by endogenous formation of NOC in relation to dietary nitrate/nitrite exposure. Such analysis should, however, also take into account the potential contribution of physiological and/or infection-/ inflammation-mediated formation of NO and nitrosating agents. On the other side we will consider in detail the available evidence for positive health effects. A critical appraisal of biomarkers available to assess endogenous NOC formation at nitrate uptake levels considered to exert the above beneficial health effects is required. As an inherent difficulty it appears that available biomarkers may be indicative for exposure, be it of exogenous or endogenous origin, but less so for biological effects, be it negative or positive.

As a consequence of the analysis of the state of knowledge, an important task of the round table will be to define future research needs in order to establish a database that will enable a science-driven and science-based risk-benefit evaluation. The aim is to prepare an official opinion of the Senate Commission that hopefully will trigger the necessary research activities.

[1] EFSA (2008) Nitrate in vegetables – Scientific Opinion of the Panel on Contaminants in the Food Chain, *EFSA Journal* 689: 1-79

[2] Lundberg JO, Weitzberg E, Cole JA, Benjamin N (2004) Nitrate, bacteria and human health. *Nat. Rev. Microbiol.* 2(7): 593-602

[3] Lundberg JO, Carlström M, Larsen FJ, Weitzberg E (2011) Roles of dietary inorganic nitrate in cardiovascular health and disease. *Cardiovasc. Res.* 89 (3): 525-532