Metabolic effects of red meat consumption studied in a rat model

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Aim
The aim of the present study was to investigate the effects of consumption of red meat (beef) versus white meat (chicken) on the metabolome using a rat model.

Materials and methods
Twenty-four healthy rats were randomly assigned to 15 days of ad libitum feeding of one of four experimental diets: 1) lean chicken 2) fat chicken 3) lean beef 4) fat beef. Urine, feces, plasma and colon tissue samples were analyzed using proton (¹H) NMR-based metabolomics.

Results and discussion
Chicken intake resulted in a higher urinary excretion of acetate, anserine and 1-methylhistidine. The latter two might be useful as biomarkers of chicken consumption, which has also been shown in human studies. Beef intake increased urinary carnosine, fumarate, carnitine, trimethylamine (TMA) and trimethylamine N-oxide (TMAO) levels. TMA is produced from choline or carnitine by microbial fermentation in the colon. Oxidation of TMA by the FMO-enzymes in the liver, results in formation of TMAO, which is excreted in urine. Several studies have associated TMAO to cardiovascular disease, but the exact mechanism has not yet been accounted for.

Conclusions
This study for the first time identified specific differences in the metabolome related to intake of beef and chicken, respectively. These results might lead to a better understanding of the proposed effects of red meat consumption.

Figure 1. The formation of TMAO from dietary carnitine.