

Sulphate Accumulation in Prostate (SAP): A pre-biopsy window-of-opportunity trial to measure sulphate levels in human prostate after broccoli consumption

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Background: Epidemiological studies suggest a negative association between prostate cancer and dietary intake of cruciferous vegetables. These vegetables have a characteristic sulphur metabolism that allows them to deliver sulforaphane (SF), a hydrolysis product of glucoraphanin, and other specialised metabolites including S-methyl cysteine sulfoxide (SMCSO). Cultivars of broccoli have been specially bred on the Norwich Research Park to increase expression of these bioactive sulphur-containing compounds, potentially enhancing their anti-cancer activity.

We hypothesise that a high-dose broccoli diet raises levels of sulphate in tissues, driving synthesis of phosphoadenosine 5'-phosphosulphate (PAPS) and consuming adenosine triphosphate (ATP). Cancerous cells, which cannot adjust their metabolism, could therefore be susceptible to elimination.

The primary outcome of this study is: a difference in sulphate levels in the prostates of men receiving a high-broccoli diet compared to non-intervention controls.

Methods: SAP is a two-arm un-blinded study (clinicaltrials.gov ID: NCT02821728) based on power calculations from ongoing clinical trials at IFR. 18 men were randomized to either no intervention or a minimum of 4 weeks of a high-broccoli diet (3 x 300g Beneforte[®] broccoli and stilton soups per week) while on the waiting list for a trans-perineal template biopsy of the prostate. Volunteers completed a baseline health questionnaire and validated Cruciferous Vegetable Food Frequency Questionnaire (CVFFQ). Samples were collected following the study period, including biopsies of prostate and pelvic adipose tissue, blood and urine.

Results: Prostate, adipose and urine from each volunteer will be used for global metabolomic analyses by Metabolon[®]. Two cores of prostate will be used for gene expression analysis and all remaining tissue will be stored at -80°C in the Norwich Biorepository for future research. Genotyping from whole blood samples will provide an explanatory variable in the analysis of effects seen from the study diet.

Conclusions: Results are pending that could provide direct evidence of a change in prostate metabolism as a result of dietary intervention, with potential mechanistic links to prostate cancer interception.

Conflict of Interest: The broccoli with elevated glucoraphanin is the subject of patents filed by Plant Bioscience Limited (PBL), the technology transfer company of the John Innes Centre. RFM is an inventor named on these patents. PBL has licensed rights under these patents to Seminis Vegetable Seeds Inc. The John Innes Centre and RFM may receive payments from commercialisation as specified by the BBSRC Rewards to Inventors policy. No other authors declare a conflict of interest.

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