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Does daily consumption of vitamin K1 from cruciferous vegetables reach the circulation and the knee joint?

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Cruciferous vegetables, such as broccoli, cabbage and kale, are rich dietary sources of vitamin K1 (Phylloquinone); however, 55% of Irish adults have phylloquinone intakes below the EU recommendation of 1 μg · kg body weight^{-1}· day[(1)]. Vitamin K acts as an enzyme co-factor which carboxylates vitamin K-dependent proteins and is associated with cardio-metabolic[(2)] and musculoskeletal[(3)] benefit. Osteoarthritis (OA) is the most prevalent joint disorder in older adults and a major cause of disability. Emerging observational data indicate low vitamin K1 status is associated with a higher incidence of OA[(4)].

This feasibility study investigated the response of vitamin K1 in plasma and the synovial fluid of the knee joint following a broccoli-based dietary intervention in adults with knee OA. Men and post-menopausal women awaiting total knee replacement surgery were enrolled in this feasibility study as described by Davidson et al. (2017)[(5)]. Participants (n = 37, men/women 17/20, aged 70 ± 8·5 years) underwent a washout period for 7-days where cruciferous vegetable consumption was restricted; prior to being randomised to either increased broccoli consumption (100 ***g*** of cooked broccoli/day (treatment n = 17)) or no broccoli consumption (control n = 20) for 14-days prior to surgery. A fasting blood sample was collected at baseline (BL) and post-intervention (PI) (on the morning of the surgery). A synovial fluid sample was collected during surgery (n = 23; control = 13, treatment = 10). Vitamin K1 concentrations were measured in plasma and synovial fluid using reversed phase-HPLC.

Vitamin K1 concentrations did not differ across treatments at BL ($P = 0{\cdot}916$). Concentrations of vitamin K1 increased significantly in the treatment (Mean (SD): BL: 1·04 (0·9); PI: 1·82 (1·6) nmol/L) compared to the control group (BL: 1·01 (1·1); PI: 0·71 (0·5) nmol/L) ($P = 0{\cdot}001$) (Fig. 1). Vitamin K1 was detected in synovial fluid and was significantly higher in the treatment (0·24 (0·2)) compared to the control group (0·11 (0·1)) ($P = 0{\cdot}026$) (Fig. 2).

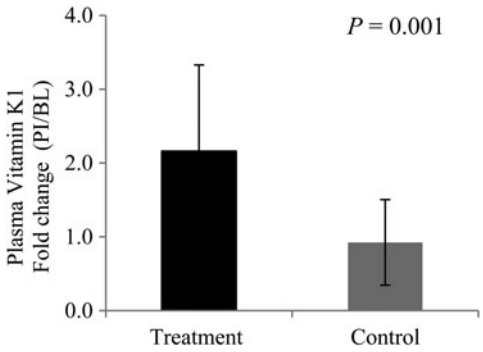

Fig. 1. Mean fold change in plasma vitamin K1 concentrations by treatment (n = 37) (Independent t test with Welch's correction).

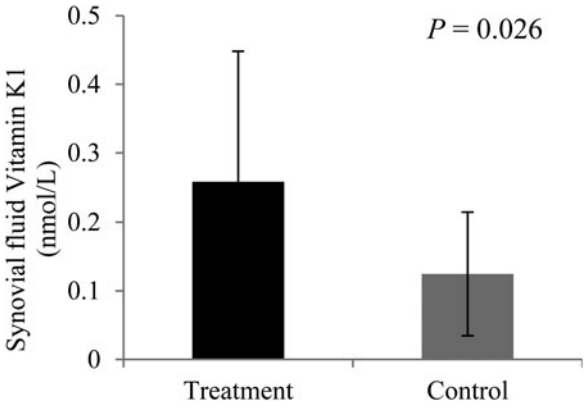

Fig. 2. Mean vitamin K1 concentrations in synovial fluid PI by treatment (n = 23) (Independent t test using log-transformed data).

Results suggest that a modest intake of broccoli (100 g/day) for two weeks significantly increased circulating vitamin K1 concentrations by approximately two-fold. The potential to modulate vitamin K1 in the synovial fluid of the knee joint in response to dietary intervention also warrants further investigation.

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