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Bioavailability of vitamin D biofortified pork meat: results of an acute human crossover study

H.R. Neill[1], C.I.R. Gill[1], E.J. McDonald[2], W.C. McRoberts[3], R. McAleenon[1], M.M. Slevin[1], D. Cobice[4], R. McMurray[2], R. Loy[3], A. White[3] and L.K. Pourshahidi[1]

[1]*School of Biomedical Sciences, Ulster University, Coleraine, Northern Ireland,*
[2]*Devenish Nutrition Ltd., Belfast, Northern Ireland,*
[3]*Agri-Food and Biosciences Institute, Belfast, Northern Ireland and*
[4]*Biomedical Sciences Research Institute, Ulster University, Coleraine, Northern Ireland*

Vitamin D intakes are concerningly low [(1)]. Relatively few foods contain high levels of vitamin D and therefore, coupled with varying diurnal ultraviolet-B (UVB) radiation intensity and poor supplement uptake, hypovitaminosis D is prevalent[(2)]. Food-based strategies, such as endogenous biofortification, are urgently warranted to increase vitamin D intakes and subsequently improve 25-hydroxyvitamin D (25(OH)D) concentrations. No research to date has explored the bioavailability of ultraviolet (UV)-biofortified pork in humans [(3)]. Therefore, the aim of the current study was to investigate the efficacy of vitamin D biofortified pork to increase 25(OH)D_3 concentrations, compared to a dose-matched vitamin D_3 supplement and control pork in adults. An acute randomised double-blind, controlled, three-way crossover study was conducted in healthy Caucasian adults ($n = 14$; age: 23 ± 6 y; body mass index: 21.8 ± 1.8 kg/m^2). Participants received either biofortified pork derived from pigs exposed UVB light (5 µg vitamin D_3/portion), control pork (1.8 µg vitamin D_3/portion) or a supplement (5 µg vitamin D_3), with a 2-week washout period between each visit. Blood samples were obtained at baseline and then 1.5, 3, 6, 9 and 24 hour postprandially. Serum 25(OH)D_3 was analysed by high-performance liquid chromatography-tandem mass spectrometry (HPLC-MS/MS). The study was registered at clinicaltrials.gov (NCT04207294). There was a significant effect of time ($p < 0.01$) and a significant treatment*time interaction ($p < 0.05$). UV pork and supplement significantly increased within-group serum 25(OH)D_3 concentrations over timepoints ($p < 0.05$). Average peak blood concentration (Cmax) values were modestly higher with supplementation (Supplement: 44.3 nmol/L; UV pork: 42.4 mol/L; Control pork 38.4 nmol/L). Between-group analysis showed no significant difference at any timepoint and there were no significant differences in area under the curve (AUC) between treatments, even when split by vitamin D status (< or ≥ 50 nmol/L). The time to maximum concentration (Tmax) was 9 hours for UV pork and supplementation, and 3 hours for control pork. Vitamin D biofortified pork increased 25(OH)D_3 concentrations and produced a similar response pattern as a dose-matched vitamin D supplement, but biofortification protocols should be further optimised to ensure differentiation from control (standard) pork. Future research should address chronic exposure to vitamin D-biofortified pork with greater vitamin D_3 concentrations, thus identifying its contribution to longer-term vitamin D status.

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