Efficacy of a Novel Food Fortification System to Combat Vitamin D Deficiency in rats

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Abstract

Background and aim of the work Fortification of foodstuffs has proven effective in preventing micronutrient deficiencies. Dairy products are fortified in Saudi Arabia, but still vitamin D (VD) deficiency is highly prevalent. Therefore, development of sable and effective alternative micronutrient delivery technologies is required. The aim of this study is to test the efficacy of the novel vitamin D-Nanoemulsion (VDN) developed by sonication and pH-shifting of pea protein in vitamin D deficient rats.

Methods A total number of 35 healthy adult male albino young rats were used. Rats shortly after weaning (3–4 weeks old, weight 78.70±10.2 g) were divided primarily into two groups: rats of the C group (n=7) were fed on normal balanced growth diet. The remaining rats (n=28) were fed on vitamin D-deficient, normal calcium and phosphorus diet for 6 weeks. Vitamin D deficient rats were subdivided into: T1 group (n=7) which treated with vitamin D-Nanoemulsion (3 ml of VDN containing 27 µg/ml VD3) for 1 week. T2 group (n=7) that treated with vitamin D3 in oil (3ml of 27 µg/ml VD3), C1 group (n=7) that treated with 3 ml of Nanoemulsion without VD, and C2 group (n=7) that treated with canola oil without vitamin D for 1 week. Plasma 25 hydroxy vitamin D3 (25OHVD), parathyroid hormone (PTH), calcium (Ca), phosphorus (P) levels and activity of alkaline phosphatase (ALP) enzyme were estimated and femur bone used to prepare histopathological sections. Image J software was used to measure the histomorphometric changes. Paired T test and ANOVA with post hoc test were used to test statistical significance.

Results Significant increase of 25 hydroxyvitamin D3 after VDN treatment in T1 group (34.38±7.00 vs 14.65±1.29, P<0.01). Comparison of VDN with VD treated groups revealed significant changes of PTH, Ca, P, & LAP levels (25.22±14.26 vs 86.05±9.67, 9.64±0.60 vs 5.32±1.28, 3.65±0.71 vs1.33±0.32 & 72.37±30.97 vs 182.62±61.83, respectively). In addition, there was a significant improvement of osteoid area and reduction of trabecular separation of the bone sections.

Conclusions Micronutrient delivery technologies such as VDN is a successful delivery system in improvement of bone status in vitamin D deficient rats. Further research should be conducted about the safety and possibility of use in human.

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