Original Research

Wheat Germ Supplementation of a Low Vitamin E Diet in Rats Affords Effective Antioxidant Protection in Tissues

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Background: Oxidative stress is implicated in the etiology of many diseases, but most of clinical trials failed to demonstrate beneficial effects of antioxidant supplementation.

Methods: In the present experiment, we assessed the mean-term effect of wheat germ supplementation, as a dietary source of vitamin E, on antioxidant protection in rat.

Results: Feeding rats a 20% wheat germ diet significantly increased plasma and liver vitamin E levels, compared to the low vitamin E basal diet. Concurrently, wheat germ diet consumption strongly decreased the susceptibility of heart and liver lipids to oxidation, as well as the plasma. Wheat germ feeding did not change triglycerides (TG) nor total cholesterol concentrations in plasma or liver, resulting in higher vitamin E/ TG ratio compared to controls. Similar results were found with a diet in which wheat germ oil provided the same amount of vitamin E.

Conclusions: Wheat germ appears thus very effective to improve antioxidant defense status, especially in tissues, irrespective of modifications of lipids status.

INTRODUCTION

Epidemiological studies clearly show that the diet plays an important role in preventing degenerative diseases such as cancer and coronary heart disease (CHD), the leading causes of mortality and morbidity in Western countries [1]. Growing evidence also suggests that the reactive oxygen species (ROS) generated during cellular metabolism and the resultant lipid peroxidation play a causative role in the pathogenesis of cancer and CHD [2]. In addition, heart failure has been found to be associated with oxidative stress in animal studies, with a concomitant lowering of antioxidant enzyme activity [3,4] and an antioxidant depletion in plasma [4] and heart [3]. Dietary antioxidants play an important role in cellular antioxidant defense mechanisms. Vitamins E and C, carotenoids, selenium, copper and zinc are the major dietary antioxidants [5]. The term "vitamin E" is used to describe isomers of tocopherol and tocotrienol that qualitatively exhibit the biological activity of α-tocopherol. The antioxidant activity of tocopherols is well documented [6,7]. One physiological role of vitamin E is its ability to react with and quench free radicals in cell membranes and other lipid environments, thereby preventing polyunsaturated fatty acids (PUFA) from oxidation. In humans, vitamin E deficiency results in oxidative stress [8] and the intake of vitamin E from food has been found to be inversely associated with the risk of death from coronary heart disease [9], possibly by inhibiting oxidative modification of low density lipoprotein (LDL) cholesterol.

It has been reported that both the presence of fat and the food matrix enhance vitamin E absorption [10]. Wheat germ, a by-product of the flour milling industry and the oil extacted

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Abbreviations: CHD = coronary heart disease, FRAP=ferric ion reducing antioxidant power, LDL = low density lipoprotein, MDA = malondialdehyde, ROS = reactive oxygen species, TBARS = thiobarbituric acid-reactive substances, TG = triglycerides, VLDL = very low density lipoprotein, PUFA = polyunsaturated fatty acids, WG = wheat germ, WGO = wheat germ oil.