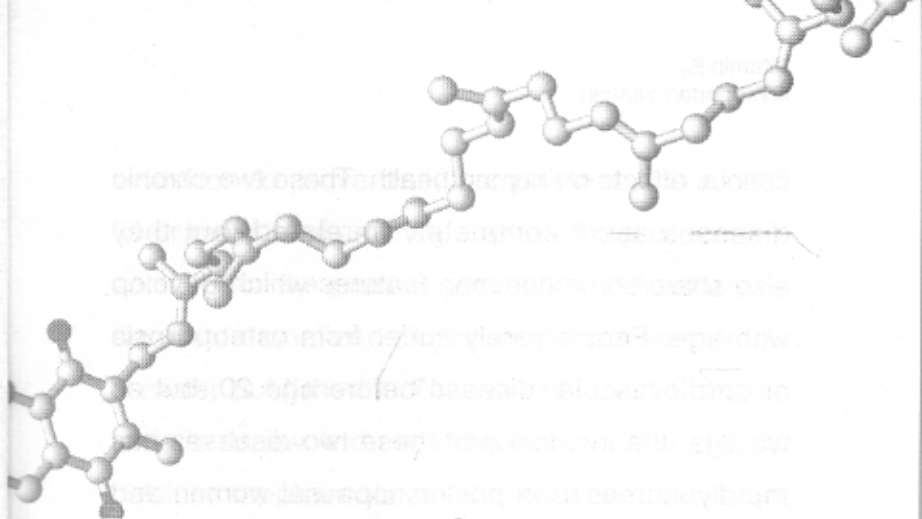




Preface

With the improvement of living standards and the development of medical and health services, our average life expectancy has grown. In 2017 the life expectancy in the world increased to 75 years (74 years for men and 77 years for women). With global prolongation of life expectancy, the incidence of various chronic diseases has increased, such as cardiovascular and cerebrovascular diseases, diabetes, chronic kidney disease, cancer, and osteoporosis.

Osteoporosis and cardiovascular disease have

serious effects on human health. These two chronic diseases seem completely unrelated, but they also share some common features which develop with age. People rarely suffer from osteoporosis or cardiovascular disease before age 20, but as we age, the incidence of these two diseases has rapidly increased in postmenopausal women and men over 60 or 70 years of age. In recent years, a number of studies have shown that vitamin D and calcium supplementation cannot reduce the incidence of fractures in people aged 50 and over. Excessive amount of vitamin D and calcium doesn't provide extra bone protection, and may increase the risk of fractures, even lead to serious problems such as bone hyperplasia and arteriosclerosis. From 2008 to 2011, the *British Medical Journal* published three articles, which showed that calcium supplementation (≥ 500 mg/d) are associated with an increasing risk of myocardial infarction. In 2013, the US Preventive Services Task Force (USPSTF) concluded that there was insufficient

evidence to prove daily supplementation of 400 IU or more of vitamin D₃ and 1000 mg or more of calcium for the primary prevention of fractures in noninstitutionalized postmenopausal women. In a paper published in *The Lancet* in 2014, a systematic review and meta-analysis of 23 traditional calcium supplementation studies were conducted. The results of the study showed that vitamin D and calcium supplementation did not lead to a clinically significant reduction in risk of fracture. The results caught the attention of scientists and clinicians, and then raised questions about the causes of the deposition of calcium in bone and blood vessel walls.

After 20 years of research, scientists found that vitamin K₂ deficiency is a major risk factor for osteoporosis and cardiovascular calcification. Vitamin K₂ is a fat-soluble vitamin that is currently widely studied and used in nutritional supplements, health foods, and drugs. Vitamin K₂ can effectively prevent and treat cardiovascular diseases by

promoting the deposition of calcium into the bones, reducing the deposition of calcium in blood vessels, and thus increasing bone density and strength. The above knowledge has led us to focus our attention on vitamin K₂ because of its important benefits on bone, and prevention of cardiovascular disease, diabetes, chronic kidney disease, and cancer.

There are many subtypes of vitamin K₂, of which the most studied forms are MK-4 and MK-7. MK-7 has a better bioavailability than MK-4 and is thought to be a longer-lasting, safer, and more effective form of vitamin K₂, with a greater potential for health care. Due to the limited understanding of its mechanism of action, vitamin K₂ has long been assumed to be the same material as vitamin K₁, and therefore vitamin K₂ did not receive the attention it deserved. Unlike the primary role of vitamin K₁ in the coagulation process, the main function of vitamin K₂ is to activate proteins osteocalcin and matrix Gla protein (MGP). Vitamin K₂ not only reduces the incidence of fractures but also effectively inhibits

calcification of the arteries. Moreover, recent research indicates that vitamin K₂ has beneficial effects on the treatment of other diseases such as liver cirrhosis, diabetes, muscle spasms, rheumatoid arthritis and Parkinson's disease. Thus, vitamin K₂ is known as a "revolutionary vitamin", and may be defined as a health and nutrition product in the new era. With the advancement of precision medicine, vitamin K₂ may become the focus of consumers in the world.

In this book you will systematically and comprehensively learn about vitamin K₂, including the discovery process, the mechanism of action, and impact on health. We hope to solve the existing doubts on and misunderstandings of vitamin K₂ and promote the world's understanding of its function. The purpose of this book is to make more people aware of the miracle of vitamin K₂, the "forgotten and revolutionary vitamin" on health. We hope that vitamin K₂ will have a greater contribution to the development of human health and wellness in the future.