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Biochemistry and Nutritional Aspects of Vitamin K

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Abstract

The term vitamin K refers to a variety of compounds containing a 3-position, 2-methyl-1,4-naphthoquinone ring with a hydrophobic side chain. Until the mid-1970s, when it was shown to be a substrate for a microsomal enzyme that converted protein-bound glutamyl residues to γ-carboxyglutamyl (Gla) residues, the biochemical function of the vitamin was not known. In relatively few proteins, this posttranslational modification has been found. The first protein shown to be dependent on vitamin K for its synthesis, prothrombin (coagulating factor II), the zymogen of plasma procoagulant thrombin, was also the first protein shown to contain γ-carboxylglutamyl (Gla) residues. In patients with inherited bleeding disorders, plasma clotting factors VII, IX, and X were all originally identified and were subsequently shown to be vitamin K dependent. Until the mid-1970s, the only proteins known to require this vitamin for their synthesis were these four vitamin Kdependent clotting variables. These four vitamin K-dependent procoagulants are very homologous in their amino-terminal, Gla domains, and the 10-13 Gla residues in each are basically in the same position as in prothrombin. Three more Gla-containing plasma proteins with similar homology were discovered following the discovery of Gla. Protein C and protein S have an anticoagulant rather than a procoagulant role in normal hemostasis, and under some conditions, the seventh plasma protein containing Gla (protein Z) also has an anticoagulant function. They have been extensively studied, as these proteins play a crucial role in hemostasis, and the complementary DNA (cDNA) and genomic organisation of each of them are well known. This activity was maintained by detergent-solubilized microsomal preparations, and small peptides containing adjacent Glu-Glu sequences were found to be substrates for the enzyme. A general understanding of the properties of this unique enzyme was gained from studies utilizing this crude enzyme preparation, and these data have been adequately reviewed. The vitamin K-dependent carboxylation reaction does not require adenosine triphosphate, and the energy to drive this carboxylation reaction is derived from the oxidation of the reduced, hydro naphthoquinone form of vitamin K (vitamin KH2) by O2 to form vitamin K-2,3-epoxide.

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Biography

Dr. Virginia Pascual Ramos, MD is working at Instituto Nacionalde Ciencias, Mexico City. His research interest are Conceptualization, Formal analysis, Methodology, Supervision, Validation, Visualization. His specialzations are Immunology and Rheumatology.