

# Bioavailability and Analysis of Vitamins in Foods

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# Bioavailability and Analysis of Vitamins in Foods

G.F.M. Ball



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# Preface

Every country in the world is concerned with the nutritional status of its population and in utilizing its natural food resources in the most effective way possible. Surveys based on food intakes and food compositional data are being conducted with the object of establishing recommended intakes of vitamins. These recommendations are constantly being changed as new knowledge comes to light.

Analytical techniques using physicochemical and microbiological methods have been largely developed to determine the total vitamin content of a food commodity or diet using the most rigorous extraction method commensurate with the stability of the vitamin. The extraction procedures frequently involve prolonged heating of suitably prepared food samples at extremes of pH to liberate vitamins from chemically bound forms in the food matrix or to remove a preponderance of fat from fatty foods. For several vitamins the data obtained by these means grossly overestimate the nutritional value of the food because the human digestive system fails to liberate bound vitamin forms for subsequent absorption by the intestine. This statement is borne out by reports of vitamin deficiency in situations where the dietary supply of vitamin is adequate on the basis of conventional analysis. Various research laboratories are directing their effort toward the estimation of bioavailable vitamin, i.e. the proportion of vitamin in the food which is available for utilization by the body. So far, few data have been published and there are many gaps in the knowledge required to interpret experimental results.

The main purpose of this book is to discuss the important factors that influence the bioavailability of vitamins in foods. The physiological processes of digestion and absorption are given special attention because the intestine is highly selective in allowing nutrients to enter the body proper. Other factors include the composition of the diet, the effects of alcohol and drugs, age and state of health. Food processing can result in losses of the more labile vitamins and sometimes the bioavailability of the remaining amount of vitamin is also reduced. On the other hand,

domestic cooking can increase the bioavailability of vitamins from certain foods.

Vitamin assays in foods are carried out for a variety of purposes: to implement regulatory enforcement; to check compliance with contract specifications and nutrient labelling regulations; to provide quality assurance for supplemented products; to provide data for food composition tables; to study changes in vitamin content attributable to food processing, packaging and storage; and to assess the effects of geographical, environmental and seasonal conditions. In addition, new varieties of food plants, including cereal grains, are frequently being introduced. The book surveys methods of determining vitamins in foods, with emphasis on the extraction procedures employed. Rather than using heat and strong acid or alkali to estimate the total (potential) vitamin content, a few methods use enzymatic digestion of the food matrix to estimate the available vitamin.

As to the scope of the book, the first chapter describes the functional anatomy of the small intestine and the physiology of absorption as a foundation to understanding the specific absorption mechanisms for the individual vitamins discussed in the later chapters. Chapter 2 outlines the principles of the various physicochemical, microbiological and biospecific techniques encountered in vitamin analysis and includes high-performance liquid chromatographic (HPLC) methods for determining two or three vitamins concurrently or simultaneously. HPLC and other methods for determining individual vitamins are described in the respective chapters which follow.

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