

## Extension of AOAC Official Method 999.14 (Choline in Infant Formula and Milk) to the Determination of Choline in Dietary Supplements

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AOAC Official Method 999.14 is applicable for the determination of choline in milk and infant formulas. To date, its use has not been extended beyond these matrices. We modified Official Method 999.14 and applied it to the determination of choline in a range of choline-containing dietary supplements. Dietary supplement tablets, capsules, wafers, softgels, liquid products, and drink powders were included. We found that the standard curve could be extended to cover a wider range of choline concentrations and defined a procedure for the use of Norit for samples in which the vitamin C content was high enough to interfere with the analysis. Recoveries of choline added to infant formula powders and to representative dietary supplement tablets, capsules, powdered drink mix, and wafer products were 85–114%. The use of Norit during the procedure did not affect the recovery of choline added to infant formula powders or to dietary supplements. An alkaline digestion was included for use with a product containing lecithin as the sole source of choline. Ten of 11 dietary supplement products analyzed by the modified method contained amounts of choline at or above declarations found on the product labels. The remaining product contained about 40% of the label-declared amount of choline.

**C**holine, a dietary constituent, is an important component of membrane phospholipids. It provides a source of labile methyl groups, participates in transmembrane signaling, exerts a lipotropic action on the liver, is important for lipid and cholesterol transport and metabolism, and serves as a precursor for the neurotransmitter acetylcholine (1, 2). Choline is widely distributed in foods, with most of it in the form of phosphatidylcholine in membranes. Milk, liver, eggs, and peanuts are rich in choline.

Choline is also available as a dietary supplement of choline chloride or choline bitartrate and as lecithin, which usually contains about 25% phosphatidylcholine or 3–4% choline by weight. Foods and dietary supplements may now carry nutrient content claims, including claims about choline content, as authorized under the U.S. Food and Drug Administration Modernization Act (3).

Relatively few methods for the analysis of choline appear in the literature. Recently published methods report the use of proton nuclear magnetic resonance spectroscopy (4), liquid chromatography/electrospray ionization-isotope dilution mass spectrometry (5), and choline biosensors (6) for the quantitation of choline and its metabolites in several matrices. Instrumentation requirements of some of these methods may put them out of the reach of laboratories needing rapid and routine analyses for choline in foods and dietary supplements.

We studied the recently adopted AOAC Official Method 999.14 (Choline in Infant Formula and Milk—Enzymatic Colorimetric Method; 7, 8) to determine its applicability to the analysis of choline in matrices such as dietary supplements that may bear choline content claims. We used standard reference material (SRM) 1846 (Infant Formula), which has a noncertified reference value for choline, as an in-house quality assurance/quality control (QA/QC) material. We analyzed 5 infant formula powders and 11 dietary supplements of different types.

### Experimental

#### Principle

The test sample is digested in acid (or, if needed, alkali) at 70°C, thereby releasing most of the choline. Following pH adjustment, treatment of hydrolysates with Norit (Fisher Scientific Co., Fairland, NJ) is included if needed to reduce interference from vitamin C. Residual choline phospholipids are then cleaved with phospholipase D, and the free choline moiety is subjected to choline oxidase with subsequent liberation of hydrogen peroxide. In the presence of peroxidase, phenol is oxidized and a quinoneimine chromophore is formed with 4-aminoantipyrine. Both enzymatic and color-forming reactions are formatted to occur concurrently. Absorbance is measured at 505 nm and choline

# **Aoac Official Method Milk**

**Megh R. Goyal,N. Veena,Santosh  
Kumar Mishra**

## **Aoac Official Method Milk:**

**Analytical Methods for Milk and Milk Products** Megh R. Goyal, N. Veena, Santosh Kumar Mishra, 2024-02-20 This new three volume set comprehensively illustrates a wide range of analytical techniques and methodologies for assessing the physical chemical and microbiological properties of milk and milk products to ensure nutritional and technological quality and safety of milk and milk products This volume focuses on various analytical methods for physicochemical and compositional analysis of concentrated coagulated and fermented dairy products in detail It also describes the standard methodologies for the analysis of nutraceutical components and food additives commonly used in various dairy products to meet technological and nutritional quality standards The other volumes are Volume 1 Sampling Methods Chemical and Compositional Analysis Volume 3 Microbiological Analysis is forthcoming Together these three volumes will be a complete and thorough reference on analytical methods for milk and milk products The volumes will be valuable for researchers scientists food analysts food analysis and research laboratory personnel involved in the area of milk and milk products analysis as well as for faculty and students

**Handbook of Dairy Foods Analysis** Leo M.L. Nollet, Fidel Toldra, 2009-11-04 Dairy foods account for a large portion of the Western diet but due to the potential diversity of their sources this food group often poses a challenge for food scientists and their research efforts Bringing together the foremost minds in dairy research Handbook of Dairy Foods Analysis compiles the top dairy analysis techniques and methodologies from around the world into one well organized volume Co Edited by Fidel Toldra Recipient of the 2010 Distinguished Research Award from the American Meat Science Association Exceptionally comprehensive both in its detailing of methods and the range of products covered this handbook includes tools for analyzing chemical and biochemical compounds and also bioactive peptides prebiotics and probiotics It describes noninvasive chemical and physical sensors and starter cultures used in quality control Covers the Gamut of Dairy Analysis Techniques The book discusses current methods for the detection of microorganisms allergens and other adulterations including those of environmental origin or introduced during processing Other methodologies used to evaluate color texture and flavor are also discussed Written by an International Panel of Distinguished Contributors Under the editorial guidance of renowned authorities Leo M L Nollet and Fidel Toldra this handbook is one of the few references that is completely devoted to dairy food analysis a extremely valuable reference for those in the dairy research processing and manufacturing industries

**Residue Analysis in Food** Michael O'Keefe, 2014-04-21 Residue analysis in food is an essential science in terms of the number of laboratories and analysts involved worldwide and the range of analytical techniques available This text uniquely combines the principles and applications of the various techniques employed in residue analysis so as to provide the reader with a thorough understanding and pr

**Technology of Dairy Products** Ralph Early, 1998 This second revised edition of The technology of dairy products continues to explain methods of milk product manufacture the technology involved and how other influences affect finished products

**Vitamin Analysis for the Health and Food**

**Sciences** Ronald R. Eitenmiller, W. O. Landen Jr., Lin Ye, 2016-04-19 Employing a uniform easy to use format Vitamin Analysis for the Health and Food Sciences Second Edition provides the most current information on the methods of vitamin analysis applicable to foods supplements and pharmaceuticals Highlighting the rapid advancement of vitamin assay methodology this edition emphasizes the use of improved

**Food Safety** Umile Gianfranco Spizzirri, Giuseppe Cirillo, 2016-12-06 Food safety and quality are key objectives for food scientists and industries all over the world To achieve this goal several analytical techniques based on both destructive detection and nondestructive detection have been proposed to fit the government regulations The book aims to cover all the analytical aspects of the food quality and safety assessment For this purpose the volume describes the most relevant techniques employed for the determination of the major food components e g protein polysaccharides lipids vitamins etc with peculiar attention to the recent development in the field Furthermore the evaluation of the risk associated with food consumption is performed by exploring the recent advances in the detection of the key food contaminants e g biogenic amines pesticides toxins etc Chapters tackle such subject as GMO Analysis Methods in Food Current Analytical Techniques for the Analysis of Food Lipids Analytical Methods for the Analysis of Sweeteners in Food Analytical Methods for Pesticides Detection in Foodstuffs Food and Viral Contamination Application of Biosensors to Food Analysis

Handbook of Dairy Foods Analysis Fidel Toldrá, Leo M.L. Nollet, 2021-03-29 Dairy foods account for a large portion of the Western diet but due to the potential diversity of their sources this food group often poses a challenge for food scientists and their research efforts Bringing together the foremost minds in dairy research Handbook of Dairy Foods Analysis Second Edition compiles the top dairy analysis techniques and methodologies from around the world into one well organized volume Exceptionally comprehensive in both its detailing of methods and the range of dairy products covered this handbook includes tools for analyzing chemical and biochemical compounds and also bioactive peptides prebiotics and probiotics It describes noninvasive chemical and physical sensors and starter cultures used in quality control This second edition includes four brand new chapters covering the analytical techniques and methodologies for determining bioactive peptides preservatives activity of endogenous enzymes and sensory perception of dairy foods and all other chapters have been adapted to recent research All other chapters have been thoroughly updated Key Features Explains analytical tools available for the analysis of the chemistry and biochemistry of dairy foods Covers a variety of dairy foods including milk cheese butter yogurt and ice cream Analysis of nutritional quality includes prebiotics probiotics essential amino acids bioactive peptides and healthy vegetable origin compounds Includes a series of chapters on analyzing sensory qualities including color texture and flavor Covering the gamut of dairy analysis techniques the book discusses current methods for the analysis of chemical and nutritional compounds and the detection of microorganisms allergens contaminants and or other adulterations including those of environmental origin or introduced during processing Other methodologies used to evaluate color texture and flavor are also discussed Written by an international panel of distinguished contributors under the editorial

guidance of renowned authorities Fidel Toldr and Leo M L Nollet this handbook is one of the few references that is completely devoted to dairy food analysis an extremely valuable reference for those in the dairy research processing and manufacturing industries *Safety Evaluation of Certain Mycotoxins in Food* Joint FAO/WHO Expert Committee on Food Additives. Meeting, Food and Agriculture Organization of the United Nations, 2001 This volume contains monographs prepared at the fifty sixth meeting of the Joint FAO WHO Expert Committee on Food Additives JECFA Five mycotoxins or groups of mycotoxins that contaminate food commodities were evaluated at the meeting aflatoxin M1 fumonisins B1 B2 and B3 ochratoxin A deoxynivalenol and T 2 and HT 2 toxins The monographs in this volume summarize the data that were reviewed on these contaminants including information on metabolism and toxicity epidemiology analytical methods for their measurement in food commodities sampling protocols effects of processing levels and patterns of contamination of food commodities food consumption and prevention and control Based upon this information the Committee assessed the risks associated with intake of these mycotoxins **Food Protein Analysis** Richard Owusu-Apenten, 2002-05-24 Ideal for planning performing and interpreting food protein analyses especially as it relates to the effect of food processing on protein investigation results Delineates basic research principles practices and anticipated outcomes in each of the illustrated protein assays **Vitamins In Foods** George F.M. Ball, 2005-11-01 To achieve and maintain optimal health it is essential that the vitamins in foods are present in sufficient quantity and are in a form that the body can assimilate *Vitamins in Foods Analysis Bioavailability and Stability* presents the latest information about vitamins and their analysis bioavailability and stability in foods *Oils and Fats Authentication* Michael Jee, 2009-02-12 Quality assessment and the need for authentication are important features of the food and personal care products industries This volume provides an overview of the methods relevant to analysis and authentication of oils and fats All the major oils and fats are included Chapter authors are drawn from the academic and industrial sectors The volume is directed at chemists and technologists working in the food industry the pharmaceutical industry and in oils and fats processing It will also be of interest to analytical chemists and quality assurance personnel **Federal Register**, 1993 *Aflatoxins* Irineo Torres-Pacheco, 2011-10-21 This book is divided into three sections The section called Aflatoxin Contamination discusses the importance that this subject has for a country like the case of China and mentions examples that illustrate the ubiquity of aflatoxins in various commodities The section Measurement and Analysis describes the concept of measurement and analysis of aflatoxins from a historical perspective the legal and the state of the art in methodologies and techniques Finally the section entitled Approaches for Prevention and Control of Aflatoxins on Crops and on Different Foods describes actions to prevent and mitigate the genotoxic effect of one of the most conspicuous aflatoxins AFB1 In turn it points out interventions to reduce identified aflatoxin induced illness at agricultural dietary and strategies that can control aflatoxin Besides the preventive management several approaches have been employed including physical chemical biological treatments and solvent extraction to detoxify AF in contaminated feeds

and feedstuffs      **Improving the Safety and Quality of Milk** M. Griffiths, 2010-04-08 Consumers demand quality milk with a reasonable shelf life a requirement that can be met more successfully by the milk industry through use of improved processes and technologies Guaranteeing the production of safe milk also remains of paramount importance Improving the safety and quality of milk provides a comprehensive and timely reference to best practice and research advances in these areas Volume 1 focuses on milk production and processing Volume 2 covers the sensory and nutritional quality of cow s milk and addresses quality improvement of a range of other milk based products The opening section of Volume 1 Milk production and processing introduces milk biochemistry and raw milk microbiology Part two then reviews major milk contaminants such as bacterial pathogens pesticides and veterinary residues The significance of milk production on the farm for product quality and safety is the focus of Part three Chapters cover the effects of cows diet and mastitis among other topics Part four then reviews the state of the art in milk processing Improving the quality of pasteurised milk and UHT milk and novel non thermal processing methods are among the subjects treated With its distinguished editor and international team of contributors volume 1 of Improving the safety and quality of milk is an essential reference for researchers and those in industry responsible for milk safety and quality Addresses consumer demand for improved processes and technologies in the production safety and quality of milk and milk products Reviews the major milk contaminants including bacterial pathogens pesticides and veterinary residues as well as the routes of contamination analytical techniques and methods of control Examines the latest advances in milk processing methods to improve the quality and safety of milk such as modelling heat processing removal of bacteria and microfiltration techniques      **Methods of Analysis of Food Components and Additives** Semih Otles, 2011-11-16 With diet health and food safety news making headlines on a regular basis the ability to separate identify and analyze the nutrients additives and toxicological compounds found in food and food components is more important than ever This requires proper training in the application of best methods as well as efforts to improve existing meth      **Advances in Food Authenticity Testing** Gerard Downey, 2016-08-08 Advances in Food Authenticity Testing covers a topic that is of great importance to both the food industry whose responsibility it is to provide clear and accurate labeling of their products and maintain food safety and the government agencies and organizations that are tasked with the verification of claims of food authenticity The adulteration of foods with cheaper alternatives has a long history but the analytical techniques which can be implemented to test for these are ever advancing The book covers the wide range of methods and techniques utilized in the testing of food authenticity including new implementations and processes The first part of the book examines in detail the scientific basis and the process of how these techniques are used while other sections highlight specific examples of the use of these techniques in the testing of various foods Written by experts in both academia and industry the book provides the most up to date and comprehensive coverage of this important and rapidly progressing field Covers a topic that is of great importance to both the food industry and the governmental agencies tasked with verifying

the safety and authenticity of food products Presents a wide range of methods and techniques utilized in the testing of food authenticity including new implementations and processes Highlights specific examples of the use of the emerging techniques and testing strategies for various foods     **Listeria, Listeriosis, and Food Safety** Elliot T. Ryser, Elmer H. Marth, 2007-03-27 Completely revised the new edition of this bestseller incorporates recent findings to present readers with a complete and current overview of foodborne listeriosis including information on listeriosis in animals and humans pathogenesis methods of detection and subtyping Two new chapters deal with risk assessment cost of outbreaks regulatory control in various countries and future directions for research The text covers many high risk foods including fermented and unfermented dairy products meat poultry fish seafood and products of plant origin This authoritative resource has proven in to be a critical tool for those involved with preventing and curbing outbreaks of this dangerous pathogen     Sustainable Production in Food and Agriculture Engineering Jolanta B. Królczyk, Pawel Sobczak, Wioletta Żukiewicz-Sobczak, 2020-12-28 This book is a collection of original research and review papers that report on the state of the art and recent advancements in food and agriculture engineering such as sustainable production and food technology Encompassed within are applications in food and agriculture engineering biosystem engineering plant and animal production engineering food and agricultural processing engineering storing industry economics and production management and agricultural farms management agricultural machines and devices and IT for agricultural engineering and ergonomics in agriculture     Handbook of Food Science, Technology, and Engineering - 4 Volume Set Y. H. Hui, Frank Sherkat, 2005-12-19 Advances in food science technology and engineering are occurring at such a rapid rate that obtaining current detailed information is challenging at best While almost everyone engaged in these disciplines has accumulated a vast variety of data over time an organized comprehensive resource containing this data would be invaluable to have The     Encyclopedia of Dairy Sciences , 2011-03-25 Dairy Science Four Volume Set includes the study of milk and milk derived food products examining the biological chemical physical and microbiological aspects of milk itself as well as the technological processing aspects of the transformation of milk into its various consumer products including beverages fermented products concentrated and dried products butter and ice cream This new edition includes information on the possible impact of genetic modification of dairy animals safety concerns of raw milk and raw milk products peptides in milk dairy based allergies packaging and shelf life and other topics of importance and interest to those in dairy research and industry Fully reviewed revised and updated with the latest developments in Dairy Science Full color inserts in each volume illustrate key concepts Extended index for easily locating information

## The Enigmatic Realm of **Aoac Official Method Milk**: Unleashing the Language is Inner Magic

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