

National Health and Nutrition Examination Survey 2003-2004

Documentation, Codebook, and Frequencies

Laboratory Component:

Erythrocyte Protoporphyrin and
Selenium

Survey Years:
2003 to 2004

SAS Export File:
L39EPP_C.XPT



First Published: January 2006
Last Revised: January 2007

NHANES 2003–2004 Data Documentation

Laboratory Assessment: Lab 39 - Erythrocyte Protoporphyrin and Selenium

Years of Coverage: 2003–2004

First Published: January 2006

Last Revised: January 2007

Component Description

This documentation was revised to add selenium data to the already publicly released erythrocyte protoporphyrin data.

Protoporphyrin and Selenium

The objectives of this component are: 1) to provide data for monitoring secular trends in measures of nutritional status in the U.S. population; 2) to evaluate the effect of people's habits and behaviors such as physical activity and the use of alcohol, tobacco, and dietary supplements on people's nutritional status; and 3) to evaluate the effect of changes in nutrition and public health policies including welfare reform legislation, food fortification policy, and child nutrition programs on the nutritional status of the U.S. population.

These data will be used to estimate deficiencies and toxicities of specific nutrients in the population and subgroups, to provide population reference data, and to estimate the contribution of diet, supplements, and other factors to serum levels of nutrients. Data will be used for research to further define nutrient requirements as well as optimal levels for disease prevention and health promotion.

Eligible Sample

Protoporphyrin: Participants aged 3-5 years and females 14-49 years were tested.

Selenium: Participants aged 40 years and older were tested.

Description of Laboratory Methodology

Protoporphyrin:

Porphyryns and heme components are extracted from whole blood into a 4:1 mixture of ethyl acetate-acetic acid. Porphyryns are then separated from heme by back-extraction into a 1.5 M hydrochloric acid solution, and quantitatively determined by molecular fluorometry using a spectrofluorometer calibrated with protoporphyrin IX (PPIX) standard solutions; however, the exact concentration of the standards must first be established using molecular absorbance, Beer's Law, and the millimolar absorptivity of PPIX.

The analytical method for EP routinely employed by the EP Lab is

based largely on those originally described by Sassa et al. (1973) and Chisolm and Brown (1975). New York State's extraction method owes much to contributions from other public health labs, including the CDC, and closely follows the key elements of the consensus method for EP as published by the National Committee for Clinical Laboratory Standards (NCCLS C42-A*, 2001). At the invitation of Dr. Sassa, the EP Laboratory's routine method for EP was published as Unit 8.8 in Current Protocols in Toxicology, 1999 by J. Wiley & Sons, Inc. Elements of this protocol are reproduced below, but a reprint of the original publication is available from the EP lab director.

Selenium:

(a) Clinical relevance

This method is used to achieve rapid and accurate quantification of multiple elements of toxicological and nutritional interest. The method is sensitive enough to be used to rapidly screen serum specimens from subjects suspected to be exposed to a number of important toxic elements or to evaluate environmental or other nonoccupationally exposure to these same elements.

(b) Test principle

Inductively coupled plasma-mass spectrometry is a multielement analytical technique. Liquid samples are introduced into the ICP through a nebulizer and spray chamber carried by a flowing argon stream. By coupling radio frequency power into flowing argon, a plasma is created in which the predominate species are positive argon ions and electrons. The sample passes through a region of the plasma having a temperature of 6000 - 8000°C. The thermal energy atomizes the sample, and then ionizes the atoms. The ions, along with the argon, enter the mass spectrometer through an interface that separates the ICP, which is operating at atmospheric pressure, from the mass spectrometer, which is operating at a pressure of 10⁻⁶ torr.

The mass spectrometer permits detection of ions at each mass in rapid sequence, allowing individual isotopes of an element to be firm. The dynamic reaction cell (DRC) component of the instrument is pressurized with an appropriate reaction gas and also contains a quadrupole. In the DRC, elimination or reduction of argon based interferences take place through the interaction of the reaction gas with the interfering polyatomic species in the incoming ion beam. The quadrupole in the DRC allows elimination of unwanted reaction by-products, which would otherwise react to form new interferences. Electrical signals resulting

from the detection of the ions are processed into digital information that is used to indicate the intensity of the ions and subsequently the concentration of the element. In this method, Se (isotope mass 78 and/or mass 80), and gallium (mass 69) are measured in serum by inductively coupled plasma dynamic reaction cell spectrometry using methane as reaction gas. Serum samples are diluted 100 μ L + 100 μ L with 18 M-- 5 -ohm de-ionized water and + 2200 μ L with diluent (1% v/v nitric acid, 0.01% v/v Triton X-100, 2% v/v ethanol containing gallium for internal standardization).

There were changes in laboratory from the previous two years for selenium.

Protoporphyrin

The Division of Laboratory Sciences, National Center for Environmental Health, Centers for Disease Control and Prevention performed testing from 1999 to 2001. The State of New York Department of Health, Wadsworth Center, Trace Elements Laboratory began testing from 2002 to 2004.

Selenium

The Division of Laboratory Sciences, National Center for Environmental Health (NCEH), Centers for Disease Control and Prevention performed testing from 1999 to 2001. There was no testing in 2002. The State of New York Department of Health, Wadsworth Center, Trace Elements Laboratory began testing from 2003 to 2004.

An atomic absorption spectrometry method was used from 1999 to 2000 and an Inductively Coupled Plasma Dynamic Reaction Cell Mass Spectrometry (ICP-DRC-MS) in 2001 at NCEH. An Inductively Coupled Plasma-Dynamic Reaction Cell-Mass Spectrometry (ICP-DRC-MS) method was used from 2003 to 2004 at the Trace Elements Laboratory.

Laboratory Quality Control and Monitoring

The NHANES quality control and quality assurance protocols (QA/QC) meet the 1988 Clinical Laboratory Improvement Act mandates. A detailed quality control and quality assurance instruction was discussed in the NHANES Laboratory/Medical Technologists Procedures Manual (LPM). Read the LABDOC file for detailed QA/QC protocols.

Data Processing and Editing

Specimens were processed, stored and shipped to the State of New York Department of Health, Wadsworth Center, Trace Metals Laboratory, Albany, New York. Detailed specimen collection and processing instructions was discussed in the NHANES LPM. Read the LABDOC file for detailed data processing and editing protocols. The analytical methods were described in the **Description of the Laboratory Methodology** section.

There was no top coding in this file.

Protoporphyrin

The age range for protoporphyrin changed to males and females 3 to 5 years and females 12 to 49 years in 2003-2004 from 1 year and older from the previous 2 years.

Selenium

The age range for selenium changed to 40 years and older in 2003-2004 from 3 to 11 years from 1999-2001. There was no selenium testing in 2002.

Two derived variables were created in this data file. The formula for their derivation is as follows:

LBDEPPSI:

The protoporphyrin in $\mu\text{g/dL}$ RBC (LBXEPP) was converted to $\mu\text{mol/L}$ (LBDEPPSI) by multiplying by 0.0177.

LBDSELSI:

The protoporphyrin in ng/mL (LBXSEL) was converted to nmol/L (LBDSELSI) by multiplying by 0.0127.

Analytic Notes

The analysis of NHANES 2003-2004 laboratory data must be conducted with the key survey design and basic demographic variables. The NHANES 2003-2004 Household Questionnaire Data Files contain demographic data, health indicators, and other related information collected during household interviews. They also contain all survey design variables and sample weights for these age groups. The phlebotomy file includes auxiliary information such as the conditions precluding venipuncture. The household questionnaire and phlebotomy files may be linked to the laboratory data file using the unique survey participant identifier SEQN.

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Locator Fields

Title: Erythrocyte Protoporphyrin and Selenium

Contact Number: 1-866-441-NCHS

Years of Content: 2003–2004

First Published: January 2006

Revised: January 2007

Access Constraints: None

Use Constraints: None

Geographic Coverage: National

Subject: Erythrocyte Protoporphyrin and Selenium

Record Source: NHANES 2003–2004

Survey Methodology: NHANES 2003–2004 is a stratified multistage probability sample of the civilian non-institutionalized population of the U.S.

Medium: NHANES Web site; SAS transport files

**National Health and Nutrition Examination Survey
Codebook for Data Production (2003-2004)**

**Erythrocyte Protoporphyrin and Selenium (L39EPP_C)
Person Level Data**

First Published: January 2006

Last Revised: January 2007



| | |
|---|--|
| SEQN | Target |
| | B(3 Yrs. to 5 Yrs.) F(12 Yrs. to 49 Yrs.) B(40 Yrs. to 150 Yrs.) |
| Hard Edits | SAS Label |
| | Respondent sequence number |
| English Text: Respondent sequence number | |
| English Instructions: | |

| | |
|--|---|
| LBXEPP | Target |
| | B(3 Yrs. to 5 Yrs.) F(12 Yrs. to 49 Yrs.) |
| Hard Edits | SAS Label |
| | Protoporphyrin(ug/dL RBC) |
| English Text: Protoporphyrin(ug/dL RBC) | |
| English Instructions: | |

| Code or Value | Description | Count | Cumulative | Skip to Item |
|---------------|-----------------|-------|------------|--------------|
| 12 to 744 | Range of Values | 2665 | 2665 | |
| . | Missing | 4899 | 7564 | |

| | |
|---|---|
| LBDEPSI | Target |
| | B(3 Yrs. to 5 Yrs.) F(12 Yrs. to 49 Yrs.) |
| Hard Edits | SAS Label |
| | Protoporphyrin (umol/L RBC) |
| English Text: Protoporphyrin(umol/L RBC) | |
| English Instructions: | |

| Code or Value | Description | Count | Cumulative | Skip to Item |
|---------------|-----------------|-------|------------|--------------|
| 0.21 to 13.24 | Range of Values | 2665 | 2665 | |
| . | Missing | 4899 | 7564 | |

| | | | | |
|-------------------------------------|------------------------|--------------|-------------------|---------------------|
| LBXSEL | Target | | | |
| | B(40 Yrs. to 150 Yrs.) | | | |
| Hard Edits | SAS Label | | | |
| 0 to 999 | Selenium(ug/L) | | | |
| English Text: Selenium(ug/L) | | | | |
| English Instructions: | | | | |
| Code or Value | Description | Count | Cumulative | Skip to Item |
| 51 to 313 | Range of Values | 2903 | 2903 | |
| . | Missing | 4661 | 7564 | |

| | | | | |
|---------------------------------------|------------------------|--------------|-------------------|---------------------|
| LBDSELSI | Target | | | |
| | B(40 Yrs. to 150 Yrs.) | | | |
| Hard Edits | SAS Label | | | |
| | Selenium(umol/L) | | | |
| English Text: Selenium(umol/L) | | | | |
| English Instructions: | | | | |
| Code or Value | Description | Count | Cumulative | Skip to Item |
| 0.6 to 4 | Range of Values | 2903 | 2903 | |
| . | Missing | 4661 | 7564 | |