National Health and Nutrition Examination Survey

2017-March 2020 Data Documentation, Codebook, and Frequencies

Iron Status - Serum (P_FETIB)

Data File: P_FETIB.xpt

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Component Description

The NHANES program suspended field operations in March 2020 due to the coronavirus disease 2019 (COVID-19) pandemic. As a result, data collection for the NHANES 2019-2020 cycle was not completed and the collected data are not nationally representative. Therefore, data collected from 2019 to March 2020 were combined with data from the NHANES 2017-2018 cycle to form a nationally representative sample of NHANES 2017-March 2020 pre-pandemic data. These data are available to the public. Please refer to the Analytic Notes section for more details on the use of the data.

Specific goals of the serum iron status component include providing data in a nationally representative sample to: 1) assess overall iron status and function; 2) assess iron deficiency anemia and anemias of chronic diseases; 3) monitor trends in measures of nutritional status; and 4) assess and provide estimates of liver function in support of the liver elastography component.

Eligible Sample

Examined participants aged 12 years and older, in the NHANES 2017-March 2020 pre-pandemic sample, were eligible.

Description of Laboratory Methodology

All methods were measured on the Roche Cobas 6000 (c501 module) analyzer.

Iron (Frozen)

The Roche method of iron measurement is a three-step process using the FerroZine reagent: Fe3+ is liberated from transferrin by acid/detergent, Fe3+ is reduced to Fe2+ by ascorbate, and the reduced iron then reacts with the FerroZine reagent to form a colored complex. The intensity of this final product is directly proportional to the iron concentration in the sample.

Unsaturated Iron Binding Capacity (UIBC)

In the first step of the measurement process in the Roche method for UIBC, excess Fe2+ is added to the specimen. In an alkaline environment it is converted to Fe3+ as it binds to the unbound endogenous transferrin. The unbound Fe2+ in the reagent then reacts with the FerroZine reagent to form a colored compound. This is an inverse outcome: greater color development indicates the transferrin is more highly occupied by iron (low UIBC). Lesser color development indicates that the transferrin has more binding capacity available (high UIBC). Because of this characteristic and the calibration model, all results are multiplied by a factor (-1) to yield a positive result. This is a two-point, endpoint reaction, with measurement occurring at 546 nm (secondary wavelength 700 nm).

Total Iron Binding Capacity (TIBC)

Total Iron Binding Capacity (TIBC) was calculated indirectly using Iron (frozen), serum and Unsaturated Iron Binding Capacity, serum (UIBC):

Calculated TIBC (LBDTIB) = [Iron (frozen), serum (LBXIRN) + UIBC, serum (LBXUIB)]

Transferrin Saturation (%Sat)

Transferrin saturation (%Sat) value was calculated using Iron (frozen), serum and calculated Total Iron Binding Capacity (TIBC):

Calculated %Sat (LBDPCT) = [Iron (frozen), serum (LBXIRN) / TIBC (LBDTIB)] x 100

Refer to the Laboratory Method Files section for a detailed description of the laboratory methods used.

Laboratory Method Files

Iron Status - Iron (Frozen) (February 2020)

Iron Status - UIBC (Frozen) (February 2020)

Iron (Frozen) Laboratory Procedure Manual (August 2021)

UIBC Laboratory Procedure Manual (August 2021)

Laboratory Quality Assurance and Monitoring

Serum specimens were processed, stored, and shipped to the University of Minnesota, Minneapolis, MN for analysis.

Detailed instructions on specimen collection and processing are discussed in the NHANES 2017-2018 and 2019-2020 Laboratory Procedures Manuals (LPMs). Vials were stored under appropriate frozen (–30°C) conditions until they were shipped to the University of Minnesota for testing.

The NHANES quality assurance and quality control (QA/QC) protocols meet the 1988 Clinical Laboratory Improvement Act mandates. Detailed QA/QC instructions are discussed in the NHANES LPMs.

Mobile Examination Centers (MECs)

Laboratory team performance is monitored using several techniques. NCHS and contract consultants use a structured competency assessment evaluation during visits to evaluate both the quality of the laboratory work and the QC procedures. Each laboratory staff member is observed for equipment operation, specimen collection and preparation; testing procedures and constructive feedback are given to each staff member. Formal retraining sessions are conducted annually to ensure that required skill levels were maintained.

Analytical Laboratories

NHANES uses several methods to monitor the quality of the analyses performed by the contract laboratories. In the MEC, these methods include performing blind split specimens collected on “dry run” sessions. In addition, contract laboratories randomly perform repeat testing on 2% of all specimens.

NCHS developed and distributed a quality control protocol for all CDC and contract laboratories, which outlined the use of Westgard rules (Westgard et al., 1981) when testing NHANES specimens. Progress reports containing any problems encountered during shipping or receipt of specimens, summary statistics for each control pool, QC graphs, instrument calibration, reagents, and any special considerations are submitted to NCHS quarterly. The reports are reviewed for trends or shifts in the data. The laboratories are required to explain any identified areas of concern.

Data Processing and Editing

The data were reviewed. Incomplete data or improbable values were sent to the performing laboratory for confirmation.

There were three additional variables created in this data file to convert the analyzed values into International System of Units (SI). These variables were created using the following formulas:

LBDIRNSI

The iron frozen, serum (LBXIRN) in ug/dL was converted to umol/L (LBDIRNSI) by multiplying by **0.1791**.

LBDUIBSI

The Unsaturated Iron Binding Capacity, serum (LBXUIB) in ug/dL was converted to umol/L (LBDUIBSI) by multiplying by **0.1791**.

LBDTIBSI

The calculated Total Iron Binding Capacity (LBXTIB) in ug/dL was converted to umol/L (LBDTIBSI) by multiplying by **0.1791**.

Analytic Notes

The COVID-19 pandemic required suspension of NHANES 2019-2020 field operations in March 2020 after data were collected in 18 of the 30 survey locations in the 2019-2020 sample. Data collection was cancelled for the remaining 12 locations. Because the collected data from 18 locations were not nationally representative, these data were combined with data from the previous cycle (2017-2018) to create a 2017-March 2020 pre-pandemic data file. A special weighting process was applied to the 2017-March 2020 pre-pandemic data file. The resulting sample weights in the present file should be used to calculate estimates from the combined cycles. These sample weights are not appropriate for independent analyses of the 2019-2020 data and will not yield nationally representative results for either the 2017-2018 data alone or the 2019-March 2020 data alone. Please refer to the NHANES website for additional information for the NHANES 2017-March 2020 pre-pandemic data, and for the previous 2017-2018 public use data file with specific weights for that 2-year cycle.

Refer to the 2017-2018 and 2019-2020 Laboratory Data Overview documents for general information on NHANES laboratory data.

There are over 800 laboratory tests performed on NHANES participants. However, not all participants provided biospecimens or enough volume for all the tests to be performed. The specimen availability can also vary by age or other population characteristics. For example, in 2017-March 2020, approximately 76% of children aged 1-17 years who were examined in the MEC provided a blood specimen through phlebotomy, while 95% of examined adults age 18 and older provided a blood specimen. Analysts should evaluate the extent of missing data in the dataset related to the outcome of interest as well as any predictor variables used in the analyses to determine whether additional re-weighting for item non-response is necessary.

Please refer to the NHANES Analytic Guidelines and the on-line NHANES Tutorial for further details on the use of sample weights and other analytic issues.

Demographic and Other Related Variables

The analysis of NHANES laboratory data must be conducted using the appropriate survey design and demographic variables. The NHANES 2017-March 2020 Pre-Pandemic Demographics File contains demographic data, health indicators, and other related information collected during household interviews as well as the sample design variables. The recommended procedure for variance estimation requires use of stratum and PSU variables (SDMVSTRA and SDMVPSU, respectively) in the demographic data file.

The NHANES 2017-March 2020 Fasting Questionnaire File includes auxiliary information, such as fasting status, length of fast, and the time of venipuncture.

The laboratory data file can be linked to other NHANES data file using the unique survey participant identifier (i.e., SEQN).

Detection Limits

The detection limits were constant for this analyte in the data set.

The lower limit of detection (LLOD, in ug/dL) for serum iron and UIBC:

Variable Name	Analyte Description	LLOD
LBXIRN	Iron frozen, Serum (ug/dL)	5
LBXUIB	Unsaturated Iron Binding Capacity (UIBC), Serum (ug/dL)	17

References

- Westgard J.O., Barry P.L., Hunt M.R., Groth T. A multi-rule Shewhart chart for quality control in clinical chemistry. Clin Chem (1981) 27:493-501.

Codebook and Frequencies

SEQN - Respondent sequence number

Variable Name:	SEQN
SAS Label:	Respondent sequence number
English Text:	Respondent sequence number.
Target:	Both males and females 12 YEARS - 150 YEARS

LBXIRN - Iron frozen, Serum (ug/dL)

Variable Name: LBXIRN

SAS Label: Iron frozen, Serum (ug/dL)

English Text: Iron frozen, Serum (ug/dL)

Target: Both males and females 12 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
8 to 481	Range of Values	9505	9505	
.	Missing	904	10409	

LBDIRNSI - Iron frozen, Serum (umol/L)

Variable Name: LBDIRNSI

SAS Label: Iron frozen, Serum (umol/L)

English Text: Iron frozen, Serum (umol/L)

Target: Both males and females 12 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
1.4 to 86.1	Range of Values	9505	9505	
.	Missing	904	10409	

LBXUIB - UIBC, Serum (ug/dL)

Variable Name: LBXUIB

SAS Label: UIBC, Serum (ug/dL)

English Text: Unsaturated Iron Binding Capacity (UIBC), Serum (ug/dL)

Target: Both males and females 12 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
12 to 602	Range of Values	9460	9460	
.	Missing	949	10409	

LBDUIBLC - UIBC, Serum Comment Code

Variable Name: LBDUIBLC

SAS Label: UIBC, Serum Comment Code

English Text: Unsaturated Iron Binding Capacity (UIBC), Serum Comment Code

Target: Both males and females 12 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
0	At or above detection limit	9453	9453	
1	Below lower detection limit	7	9460	
.	Missing	949	10409	

LBDUIBSI - UIBC, Serum (umol/L)

Variable Name: LBDUIBSI

SAS Label: UIBC, Serum (umol/L)

English Text: Unsaturated Iron Binding Capacity (UIBC), Serum (umol/L)

Target: Both males and females 12 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
0.18 to 107.82	Range of Values	9460	9460	
.	Missing	949	10409	

LBDTIB - Total Iron Binding Capacity TIBC (ug/dL)

Variable Name: LBDTIB

SAS Label: Total Iron Binding Capacity TIBC (ug/dL)

English Text: Total Iron Binding Capacity TIBC (ug/dL)

Target: Both males and females 12 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
139 to 621	Range of Values	9453	9453	
.	Missing	956	10409	

LBDTIBSI - Tot Iron Binding Capacity TIBC (umol/L)

Variable Name: LBDTIBSI

SAS Label: Tot Iron Binding Capacity TIBC (umol/L)

English Text: Total Iron Binding Capacity (TIBC) (umol/L)

Target: Both males and females 12 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
24.89 to 111.22	Range of Values	9453	9453	
.	Missing	956	10409	

LBDPCT - Transferrin Saturation (%)

Variable Name: LBDPCT

SAS Label: Transferrin Saturation (%)

English Text: Transferrin Saturation (%)

Target: Both males and females 12 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
2 to 92	Range of Values	9453	9453	
.	Missing	956	10409	