Test Definition: NIUC

Nickel/Creatinine Ratio, Random, Urine

Overview

Useful For

Measurement of nickel concentration for biomonitoring nickel exposure

Special Instructions

- Metals Analysis Specimen Collection and Transport

Method Name

Only orderable as part of a profile. For more information see NIUCR / Nickel/Creatinine Ratio, Random, Urine.

Inductively Coupled Plasma-Mass Spectrometry (ICP-MS)

NY State Available

Yes

Specimen

Specimen Type

Urine

Specimen Required

Only orderable as part of a profile. For more information see NIUCR / Nickel/Creatinine Ratio, Random, Urine.

Patient Preparation: High concentrations of gadolinium and iodine are known to interfere with most metal tests. If gadolinium- or iodine-containing contrast media has been administered, a specimen should not be collected for 96 hours.
Supplies: Urine Tubes, 10 mL (T068)
Container/Tube: Plastic, 10-mL urine tube or clean, plastic aliquot container with no metal cap or glued insert
Specimen Volume: 3 mL
Collection Instructions:
1. Collect a random urine specimen
2. See Metals Analysis Specimen Collection and Transport for complete instructions.

Specimen Minimum Volume

1.2 mL

Reject Due To

All specimens will be evaluated at Mayo Clinic Laboratories for test suitability.

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Urine	Refrigerated (preferred)	28 days	
	Ambient	28 days	
	Frozen	28 days	

Clinical & Interpretive

Clinical Information

Nickel (Ni) is a highly abundant element with a silvery-white appearance. Nickel is frequently combined with other metals to form alloys and is essential for the catalytic activity of some plant and bacterial enzymes but has no known role in humans. Most nickel is used to make stainless steel.

Nickel and its compounds have no characteristic odor or taste. Ni compounds are used for Ni plating, to color ceramics, to make some batteries, and as catalysts that increase the rate of chemical reactions. One of the most toxic Ni compounds is nickel carbonyl, Ni(CO)4, which is used as a catalyst in petroleum refining and in the plastics industry, is frequently employed in the production of metal alloys (which are popular for their anticorrosive and hardness properties), in nickel-cadmium rechargeable batteries, and is used as a catalyst in hydrogenation of oils. Ni(CO)4 is very toxic.

Occupational exposure to Ni occurs primarily via inhalation of Ni compounds. Inhalation of dust high in Ni content has been associated with development of lung and nasal cancer.

Food is the major source of exposure to Ni. Foods naturally high in Ni include chocolate, soybeans, nuts, and oatmeal. Individuals may also be exposed to Ni by breathing air, drinking water, or smoking tobacco containing nickel. Stainless steel and coins contain Ni. Some jewelry is plated with Ni or made from Ni alloys. Patients may be exposed to Ni in implanted devices including joint prostheses, sutures, clips, and screws made from Ni-containing alloys.

The most common harmful health effect of Ni in humans is an allergic reaction. Approximately 10% to 20% of the population is sensitive to it. The most serious harmful health effects from exposure to Ni, such as chronic bronchitis, reduced lung function, and cancer of the lung and nasal sinus, have occurred in people who have breathed dust containing certain Ni compounds while working in Ni refineries or Ni-processing plants. Urine is the specimen of choice for the determination of Ni exposure, but serum concentrations can be used to verify an elevated urine concentration.

Patients undergoing dialysis are exposed to Ni and accumulate Ni in blood and other organs; there appear to be no adverse health effects from this exposure. Hypernickelemia has been observed in patients undergoing renal dialysis. At the present time, this is considered to be an incidental finding as no correlation with toxic events has been identified. Routine monitoring of patients undergoing dialysis is currently not recommended.

Reference Values

Only orderable as part of a profile. For more information see NIUCR / Nickel/Creatinine Ratio, Random, Urine.

0-17 years: Not established

Males > or =18 years: <3.8 mcg/g creatinine
Females > or =18 years: <4.3 mcg/g creatinine

Interpretation

Values of 3.8 mcg/g creatinine and higher for male patients, or 4.3 mcg/g creatinine and higher for female patients, represent possible environmental or occupational exposure to nickel (Ni).

Ni concentrations above 50 mcg/g creatinine are of concern, suggesting excessive exposure.

Hypernickelemia, in the absence of exposure, may be an incidental finding or could be due to specimen contamination.

Cautions

Specimen collection procedures for nickel (Ni) require special collection containers, rigorous attention to ultraclean specimen collection and handling procedures, and analysis in an ultraclean facility. Unless all of these procedures are followed, increased urinary Ni results may be an incidental and misleading finding.

This test cannot determine the source compound (eg, Ni sulfate) responsible for the exposure.

Clinical Reference

1. Moreno ME, Acosta-Saavedra LC, Mez-Figueroa D, et al. Biomonitoring of metal in children living in a mine tailings zone in Southern Mexico: A pilot study. Int J Hyg Environ Health. 2010;213(4):252-258. doi:10.1016/j.ijheh.2010.03.005
2. Schulz C, Angerer J, Ewers U, Heudorf U, Wilhelm M, Human Biomonitoring Commission of the German Federal Environment Agency. Revised and new reference values for environmental pollutants in urine or blood of children in Germany derived from the German Environmental Survey on Children 2003-2006 (GerES IV). Int J Hyg Environ Health. 2009;212(6):637-647. doi:10.1016/j.ijheh.2009.05.003
3. US Department of Health and Human Services: Toxicological profile for nickel. Agency for Toxic Substances and Disease Registry. HHS; 2005. Accessed September 6, 2023. Available at www.atsdr.cdc.gov/ToxProfiles/tp15.pdf
4. Rifai N, Chiu RWK, Young I, Burnham CAD, Wittwer CT, eds: Tietz Textbook of Laboratory Medicine. 7th ed. Elsevier; 2023
5. Zambelli B, Ciurli S: Nickel and human health. In: Sigel A, Sigel H, Sigel R, eds. Interrelations between Essential Metal Ions and Human Diseases. Metal Ions in Life Sciences. Vol 13. Springer, Dordrecht; 2013:321-357
6. Begum W, Rai S, Banerjee S, et al. A comprehensive review on the sources, essentiality and toxicological profile of nickel. RSC Adv. 2022;12(15):9139-9153.

Performance

Method Description

The metal of interest is analyzed by inductively coupled plasma mass spectrometry.(Unpublished Mayo method)

PDF Report

No

Day(s) Performed

Thursday

Specimen Retention Time

14 days

Performing Laboratory Location

Mayo Clinic Laboratories - Rochester Superior Drive

Fees & Codes

Fees

- Authorized users can sign in to Test Prices for detailed fee information.
- Clients without access to Test Prices can contact Customer Service 24 hours a day, seven days a week.
- Prospective clients should contact their account representative. For assistance, contact Customer Service.

Test Classification

This test was developed and its performance characteristics determined by Mayo Clinic in a manner consistent with CLIA requirements. It has not been cleared or approved by the US Food and Drug Administration.

LOINC® Information

Test ID	Test Order Name	Order LOINC® Value
NIUC	Nickel/Creat Ratio, U	13472-6

Result ID	Test Result Name	Result LOINC® Value
614553	Nickel/Creat Ratio, U	13472-6