MG2

cobas®

Magnesium Gen.2

Order information

REF	CONTENT		Analyzer(s) on which **cobas c** pack(s) can be used
06481647190	Magnesium Gen.2 (250 tests)	System-ID 07 7486 3	COBAS INTEGRA 400 plus

Materials required (but not provided):

10759350190	Calibrator f.a.s. (12 × 3 mL)	System-ID 07 3718 6	
10759350360	Calibrator f.a.s. (12 × 3 mL, for USA)	System-ID 07 3718 6	
12149435122	Precinorm U plus (10 × 3 mL)	System-ID 07 7999 7	
12149435160	Precinorm U plus (10 × 3 mL, for USA)	System-ID 07 7999 7	
12149443122	Precipath U plus (10 × 3 mL)	System-ID 07 8000 6	
12149443160	Precipath U plus (10 × 3 mL, for USA)	System-ID 07 8000 6	
05117003190	PreciControl ClinChem Multi 1 (20 × 5 mL)	System-ID 07 7469 3	
05947626190	PreciControl ClinChem Multi 1 (4 × 5 mL)	System-ID 07 7469 3	
05947626160	PreciControl ClinChem Multi 1 (4 × 5 mL, for USA)	System-ID 07 7469 3	
05117216190	PreciControl ClinChem Multi 2 (20 × 5 mL)	System-ID 07 7470 7	
05947774190	PreciControl ClinChem Multi 2 (4 × 5 mL)	System-ID 07 7470 7	
05947774160	PreciControl ClinChem Multi 2 (4 × 5 mL, for USA)	System-ID 07 7470 7	
20756350322	NaCl Diluent 9 % (6 × 22 mL)	System-ID 07 5635 0	

English

System information

Test MG-2, test ID 0-701; test MGU-2, test ID 0-704

Intended use

In vitro test for the quantitative determination of magnesium in human serum, plasma and urine on the COBAS INTEGRA 400 plus system.

Summary[1,2,3,4,5]

Magnesium along with potassium is a major intracellular cation. Mg^{2+} is a cofactor of many enzyme systems. Thus, all ATP-dependent enzymatic reactions require Mg^{2+} as a cofactor in the ATP-magnesium complex. Approximately 69 % of magnesium ions are stored in bone. The rest are part of the intermediary metabolism, about 70 % being present in free form while the other 30 % is bound to proteins (especially albumin), citrates, phosphate, and other complex formers. The Mg^{2+} serum level is kept constant within very narrow limits (0.65-1.05 mmol/L). Regulation takes place mainly via the kidneys, especially via the ascending loop of Henle.

This assay is used for diagnosing and monitoring hypomagnesemia (magnesium deficiency) and hypermagnesemia (magnesium excess). Numerous studies have shown a correlation between magnesium deficiency and changes in calcium-, potassium- and phosphate-homeostasis which are associated with cardiac disorders such as ventricular arrhythmias that cannot be treated by conventional therapy, increased sensitivity to digoxin, coronary artery spasms, and sudden death. Additional concurrent symptoms include neuromuscular and neuropsychiatric disorders. Hypermagnesemia is found in acute and chronic renal failure, magnesium excess, and magnesium release from the intracellular space.

In addition to atomic absorption spectrometry (AAS), complexometric methods can also be used to determine magnesium.

The method described here is based on the reaction of magnesium with xylidyl blue in alkaline solution containing EGTA to mask the calcium in the sample.

Urine magnesium levels are determined in magnesium depletion tests.

Test principle[5]

Colorimetric endpoint method

- Sample and addition of R1
- Addition of SR and start of reaction:
  In alkaline solution, magnesium forms a purple complex with xylidyl blue, diazonium salt. The magnesium concentration is measured photometrically via the decrease in the xylidyl blue absorbance.

Reagents - working solutions

R1 TRIS[a]/6-aminocaproic acid buffer: 500 mmol/L, pH 11.25; EGTA: 129 µmol/L; preservative

SR Xylidyl blue: 0.28 mmol/L; detergent; preservative

a) Tris(hydroxymethyl)-aminomethane

R1 is in position B and SR is in position C.

Precautions and warnings

For in vitro diagnostic use for health care professionals. Exercise the normal precautions required for handling all laboratory reagents.

Infectious or microbial waste:
Warning: handle waste as potentially biohazardous material. Dispose of waste according to accepted laboratory instructions and procedures.

Environmental hazards:
Apply all relevant local disposal regulations to determine the safe disposal.

Safety data sheet available for professional user on request.

For USA: Caution: Federal law restricts this device to sale by or on the order of a physician.

This kit contains components classified as follows in accordance with the Regulation (EC) No. 1272/2008:

Warning

H315 Causes skin irritation.

H319 Causes serious eye irritation.

Prevention:

P264 Wash skin thoroughly after handling.

P280 Wear protective gloves/ eye protection/ face protection.

Response:

P302 + P352 IF ON SKIN: Wash with plenty of water.

P332 + P313 If skin irritation occurs: Get medical advice/attention.

P337 + P313 If eye irritation persists: Get medical advice/attention.

P362 + P364 Take off contaminated clothing and wash it before reuse.

Product safety labeling follows EU GHS guidance.

Contact phone: all countries: +49-621-7590, USA: 1-800-428-2336

MG2

Magnesium Gen.2

cobas®

Reagent handling

Ready for use

Storage and stability

Shelf life at 15-25 °C	See expiration date on **cobas c** pack label
On-board in use at 10-15 °C	12 weeks

Specimen collection and preparation

For specimen collection and preparation only use suitable tubes or collection containers.

Only the specimens listed below were tested and found acceptable.
Serum
Plasma: Li-heparin plasma

The sample types listed were tested with a selection of sample collection tubes that were commercially available at the time of testing, i.e. not all available tubes of all manufacturers were tested. Chelating anticoagulants such as EDTA, Fluoride and Oxalate must be avoided. Sample collection systems from various manufacturers may contain differing materials which could affect the test results in some cases. When processing samples in primary tubes (sample collection systems), follow the instructions of the tube manufacturer.

Centrifuge samples containing precipitates before performing the assay.

Urine: Urine samples should be acidified to pH 1 with concentrated HCl to prevent precipitation of magnesiummammonium phosphate. Collect urine samples in metal-free container.[3] Urine samples are automatically prediluted 1:5.5 (1+4.5) with NaCl solution by the instrument.

See the limitations and interferences section for details about possible sample interferences.

Stability in *serum/plasma*:[6]	7 days at 15-25 °C
	7 days at 2-8 °C
	1 year at (–15)-(–25) °C
Stability in *urine*:[6]	3 days at 15-25 °C
	3 days at 2-8 °C
	1 year at (–15)-(–25) °C

Sample stability claims were established by experimental data by the manufacturer or based on reference literature and only for the temperatures/time frames as stated in the method sheet. It is the responsibility of the individual laboratory to use all available references and/or its own studies to determine specific stability criteria for its laboratory.

Materials provided

See “Reagents – working solutions” section for reagents.

Materials required (but not provided)

NaCl Diluent 9 %, Cat. No. 20756350322, system-ID 07 5635 0 for automatic postdilution. NaCl Diluent 9 % is placed in its predefined rack position and is stable for 4 weeks on-board the COBAS INTEGRA 400 plus analyzer.

Assay

For optimum performance of the assay follow the directions given in this document for the analyzer concerned. Refer to the appropriate operator’s manual for analyzer-specific assay instructions.

Applications for serum, plasma, and urine

Test definition

Measuring mode	Absorbance
Abs. calculation mode	Endpoint
Reaction direction	Decrease
Wavelength A/B	629/520 nm
Calc. first/last	33/46
Unit	mmol/L

Serum, plasma

Reaction mode	R1-S-SR

Urine

Reaction mode	R1-S-SR
Predilution factor	5.5

Pipetting parameters

Serum, plasma, and urine		Diluent (H_2O)
R1	97 µL	
Sample	3 µL	20 µL
SR	97 µL	
Total volume	217 µL	

Calibration

Calibrator	Calibrator f.a.s. Use deionized water as zero calibrator.
Calibration mode	Linear regression
Calibration replicate	Duplicate recommended
Calibration interval	Each lot and as required following quality control procedures.

Calibration interval may be extended based on acceptable verification of calibration by the laboratory.

Traceability: This method has been standardized against atomic absorption spectrometry.

For the USA, this method has been standardized against SRM 956.

Quality control

Quality control *serum, plasma*	Precinorm U plus or PreciControl ClinChem Multi 1 Precipath U plus or PreciControl ClinChem Multi 2
Quality control *urine*	Quantitative urine controls are recommended for routine quality control.
Control interval	24 hours recommended
Control sequence	User defined
Control after calibration	Recommended

For quality control, use control materials as listed in the “Order information” section. In addition, other suitable control material can be used.

The control intervals and limits should be adapted to each laboratory’s individual requirements. Values obtained should fall within the defined limits. Each laboratory should establish corrective measures to be taken if values fall outside the defined limits.

Follow the applicable government regulations and local guidelines for quality control.

Calculation

COBAS INTEGRA analyzers automatically calculate the analyte concentration of each sample. For more details, please refer to Data Analysis in the Online Help.

Conversion factors:	mmol/L x 2.43 = mg/dL

Limitations - interference

Serum/plasma

Criterion: Recovery within ± 10 % of initial value at a magnesium concentration of 0.7 mmol/L (1.7 mg/dL).

Icterus:[7] No significant interference up to an I index of 60 for conjugated and unconjugated bilirubin (approximate conjugated and unconjugated bilirubin concentration: 1026 µmol/L or 60 mg/dL).

Hemolysis:[7] No significant interference up to an H index of 800 (approximate hemoglobin concentration: 496 µmol/L or 800 mg/dL). Hemolysis elevates results depending on the content of analyte in the lysed erythrocytes.

Lipemia (Intralipid):[7] No significant interference up to an L index of 2000. There is poor correlation between the L index (corresponds to turbidity) and triglycerides concentration.

Drugs: No interference was found at therapeutic concentrations using common drug panels.[8,9]

In very rare cases, gammopathy, in particular type IgM (Waldenström's macroglobulinemia), may cause unreliable results.[10]

Urine

Criterion: Recovery within ± 10 % of initial value at a magnesium concentration of 1.7 mmol/L (4.13 mg/dL).

Urea: No significant interference from urea up to a concentration of 1500 mmol/L (9009 mg/dL).

Drugs: No interference was found at therapeutic concentrations using common drug panels.[9]

For diagnostic purposes, the results should always be assessed in conjunction with the patient's medical history, clinical examination and other findings.

ACTION REQUIRED

Special Wash Programming: The use of special wash steps is mandatory when certain test combinations are run together on COBAS INTEGRA analyzers. Refer to the CLEAN Method Sheet for further instructions and for the latest version of the Extra wash cycle list.

Where required, special wash/carry-over evasion programming must be implemented prior to reporting results with this test.

Limits and ranges

Measuring range

Serum/plasma

0.10-2.0 mmol/L (0.243-4.86 mg/dL)

Determine samples having higher concentrations via the rerun function. Dilution of samples via the rerun function is a 1:2 dilution. Results from samples diluted using the rerun function are automatically multiplied by a factor of 2.

Urine

0.56-11.0 mmol/L (1.36-26.7 mg/dL)

Determine samples having higher concentrations via the rerun function. Dilution of samples via the rerun function is a 1:2 dilution. Results from samples diluted using the rerun function are automatically multiplied by a factor of 2.

Lower limits of measurement

Limit of Blank, Limit of Detection, and Limit of Quantitation:

Serum/plasma

Limit of Blank	= 0.05 mmol/L (0.12 mg/dL)
Limit of Detection	= 0.10 mmol/L (0.243 mg/dL)
Limit of Quantitation	= 0.10 mmol/L (0.243 mg/dL)

Urine

Limit of Blank	= 0.28 mmol/L (0.68 mg/dL)
Limit of Detection	= 0.56 mmol/L (1.36 mg/dL)
Limit of Quantitation	= 0.56 mmol/L (1.36 mg/dL)

The Limit of Blank, Limit of Detection and Limit of Quantitation were determined in accordance with the CLSI (Clinical and Laboratory Standards Institute) EP17-A2 requirements.

The Limit of Blank is the 95th percentile value from n ≥ 60 measurements of analyte-free samples over several independent series. The Limit of Blank corresponds to the concentration below which analyte-free samples are found with a probability of 95 %.

The Limit of Detection is determined based on the Limit of Blank and the standard deviation of low concentration samples.

The Limit of Detection corresponds to the lowest analyte concentration which can be detected (value above the Limit of Blank with a probability of 95 %).

The Limit of Quantitation is the lowest analyte concentration that can be reproducibly measured with a total error of 20 %. It has been determined using low concentration magnesium samples.

Expected values[11]

Serum/plasma

Newborn:	0.62-0.91 mmol/L	(1.5-2.2 mg/dL)
5 months-6 years	0.70-0.95 mmol/L	(1.7-2.3 mg/dL)
6-12 years	0.70-0.86 mmol/L	(1.7-2.1 mg/dL)
12-20 years	0.70-0.91 mmol/L	(1.7-2.2 mg/dL)
Adults:	0.66-1.07 mmol/L	(1.6-2.6 mg/dL)
60-90 years	0.66-0.99 mmol/L	(1.6-2.4 mg/dL)
> 90 years	0.70-0.95 mmol/L	(1.7-2.3 mg/dL)
Urine (24 h)	3.0-5.0 mmol/d	(72.9-121.5 mg/d)

Roche has not evaluated reference ranges in a pediatric population.

Each laboratory should investigate the transferability of the expected values to its own patient population and if necessary determine its own reference ranges.

Specific performance data

Representative performance data on the COBAS INTEGRA analyzers are given below. Results obtained in individual laboratories may differ.

Precision

Precision was determined using human samples and controls in accordance with the CLSI (Clinical and Laboratory Standards Institute) EP5-A3 requirements with repeatability (n = 84) and intermediate precision (2 aliquots per run, 2 runs per day, 21 days).
The following results were obtained:

Serum/plasma

Repeatability	***Mean mmol/L (mg/dL)***	***SD mmol/L (mg/dL)***	***CV %***
PCCC1[b)]	0.877 (2.13)	0.011 (0.027)	1.3
PCCC2[c)]	1.36 (3.30)	0.008 (0.019)	0.6
Human serum 1	0.318 (0.773)	0.009 (0.022)	2.8
Human serum 2	0.818 (1.99)	0.009 (0.022)	1.1
Human serum 3	1.12 (2.72)	0.011 (0.027)	0.9
Human serum 4	1.31 (3.18)	0.011 (0.027)	0.9
Human serum 5	1.67 (4.06)	0.025 (0.061)	1.5

Intermediate precision	***Mean mmol/L (mg/dL)***	***SD mmol/L (mg/dL)***	***CV %***
PCCC1[b)]	0.877 (2.13)	0.015 (0.036)	1.7
PCCC2[c)]	1.35 (3.28)	0.011 (0.027)	0.8
Human serum 1	0.318 (0.773)	0.012 (0.029)	3.8
Human serum 2	0.818 (1.99)	0.010 (0.024)	1.2
Human serum 3	1.12 (2.72)	0.011 (0.027)	0.9
Human serum 4	1.31 (3.18)	0.012 (0.029)	0.9
Human serum 5	1.67 (4.06)	0.026 (0.063)	1.5

b) PreciControl ClinChem Multi 1

c) PreciControl ClinChem Multi 2

Urine

Repeatability	***Mean mmol/L (mg/dL)***	***SD mmol/L (mg/dL)***	***CV %***
Liquicheck 1	1.59 (3.86)	0.065 (0.158)	4.0
Liquicheck 2	3.70 (8.99)	0.062 (0.151)	1.7
Human urine 1	0.867 (2.11)	0.043 (0.104)	5.0
Human urine 2	1.25 (3.04)	0.054 (0.131)	4.3
Human urine 3	3.97 (9.65)	0.050 (0.122)	1.3
Human urine 4	6.94 (16.9)	0.098 (0.238)	1.4
Human urine 5	8.79 (21.4)	0.161 (0.391)	1.8

Intermediate precision	***Mean mmol/L (mg/dL)***	***SD mmol/L (mg/dL)***	***CV %***
Liquicheck 1	1.59 (3.86)	0.084 (0.204)	5.2
Liquicheck 2	3.71 (9.02)	0.105 (0.255)	2.8
Human urine 1	0.867 (2.11)	0.053 (0.124)	6.1
Human urine 2	1.25 (3.04)	0.058 (0.141)	4.6
Human urine 3	3.97 (9.65)	0.078 (0.190)	2.0
Human urine 4	6.94 (16.9)	0.163 (0.396)	2.3
Human urine 5	8.79 (21.8)	0.246 (0.598)	2.8

Method comparison

Magnesium values for human serum, plasma and urine samples obtained on a COBAS INTEGRA 400 plus analyzer (y) were compared with those determined using the corresponding reagent on a **cobas c** 501 analyzer (x).

Serum/plasma

Sample size (n) = 57

Passing/Bablok[12]	Linear regression
y = 0.981x + 0.0416 mmol/L	y = 0.983x + 0.0402 mmol/L
τ = 0.976	r = 1.000

The sample concentrations were between 0.130 and 1.86 mmol/L (0.316 and 4.52 mg/dL).

Urine

Sample size (n) = 52

Passing/Bablok[12]	Linear regression
y = 1.016x + 0.0115 mmol/L	y = 1.014x + 0.0236 mmol/L
τ = 0.970	r = 1.000

The sample concentrations were between 0.610 and 10.8 mmol/L (1.48 and 26.2 mg/dL).

References

1 Külpmann WR, Stummvoll HK, Lehmann P, eds. Elektrolyte, Klinik und Labor, 2nd ed. Vienna/New York: Springer-Verlag 1997.

2 Zumkley H, Spieker C, eds. Die Magnesiumfibel. Einhorn-Presse-Verlag, Reinbek, 1991.

3 Ehrhardt V, Paschen K, Vogt W, et al. Magnesium-Bestimmung im Serum und Urin mit einer verbesserten Xylidyl-Blau-Methode. Workshop Kaiserslautern. Workshop Report Magnesium 1989.

4 Ehrhardt V, Appel W, Paschen K, et al. Evaluierung eines Xylidyl-Blau-Reagenz zur Bestimmung von Magnesium. Wien Klin Wschr 1992;104:5-11.

5 Mann CK, Yoe JH. Spectrophotometric determination of magnesium with sodium 1-azo-2-hydroxy-3-(2,4-dimethyl-carboxanilido)-napthalene-1'-(2-hydroxy-benzene-5-sulfonate) Anal Chem 1956;28:202-205.

6 Use of Anticoagulants in Diagnostic Laboratory Investigations. WHO Publication WHO/DIL/LAB/99.1 Rev. 2: Jan 2002.

7 Glick MR, Ryder KW, Jackson SA. Graphical Comparisons of Interferences in Clinical Chemistry Instrumentation. Clin Chem 1986;32:470-475.

8 Breuer J. Report on the Symposium "Drug effects in Clinical Chemistry Methods". Eur J Clin Chem Clin Biochem 1996;34:385-386.

9 Sonntag O, Scholer A. Drug interference in clinical chemistry: recommendation of drugs and their concentrations to be used in drug interference studies. Ann Clin Biochem 2001;38:376-385.

10 Bakker AJ, Mücke M. Gammopathy interference in clinical chemistry assays: mechanisms, detection and prevention. Clin Chem Lab Med 2007;45(9):1240-1243.

11 Wu AHB, ed. Tietz Clinical Guide to Laboratory Tests, 4th ed. Philadelphia, PA: WB Saunders Company 2006:706-709.

12 Bablok W, Passing H, Bender R, et al. A general regression procedure for method transformation. Application of linear regression procedures for method comparison studies in clinical chemistry, Part III. J Clin Chem Clin Biochem 1988 Nov;26(11):783-790.

A point (period/stop) is always used in this Method Sheet as the decimal separator to mark the border between the integral and the fractional parts of a decimal numeral. Separators for thousands are not used.

Any serious incident that has occurred in relation to the device shall be reported to the manufacturer and the competent authority of the Member State in which the user and/or the patient is established.

Symbols

Roche Diagnostics uses the following symbols and signs in addition to those listed in the ISO 15223-1 standard (for USA: see dialog.roche.com for definition of symbols used):

CONTENT	Contents of kit
→	Volume for reconstitution
GTIN	Global Trade Item Number

FOR US CUSTOMERS ONLY: LIMITED WARRANTY

Roche Diagnostics warrants that this product will meet the specifications stated in the labeling when used in accordance with such labeling and will be free from defects in material and workmanship until the expiration date printed on the label. THIS LIMITED WARRANTY IS IN LIEU OF ANY OTHER WARRANTY, EXPRESS OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR PARTICULAR PURPOSE. IN NO EVENT SHALL ROCHE DIAGNOSTICS BE LIABLE FOR INCIDENTAL, INDIRECT, SPECIAL OR CONSEQUENTIAL DAMAGES.

CE 0123

Roche Diagnostics GmbH, Sandhofer Strasse 116, D-68305 Mannheim
www.roche.com
+800 5505 6606

Distribution in USA by:
Roche Diagnostics, Indianapolis, IN
US Customer Technical Support 1-800-428-2336