ALP2

Alkaline phosphatase acc. to IFCC Gen.2

Materials provided

REF		CONTENT	Analyzer(s) on which cobas c pack(s) can be used
08056757190*	08056757500	Alkaline Phosphatase acc. to IFCC Gen.2 (1100 tests)	**cobas** c 303, **cobas** c 503, **cobas** c 703
08056757214*	08056757500	Alkaline Phosphatase acc. to IFCC Gen.2 (1100 tests)	**cobas** c 303, **cobas** c 503, **cobas** c 703

* Some kits shown may not be available in all countries.

For reagents, refer to the "Reagents" section.

Materials required (but not provided)

REF	Description	Code
10759350190	Calibrator f.a.s. (12 × 3 mL)	20401
05117003190	PreciControl ClinChem Multi 1 (20 × 5 mL)	20391
05947626190	PreciControl ClinChem Multi 1 (4 × 5 mL)	20391
05117216190	PreciControl ClinChem Multi 2 (20 × 5 mL)	20392
05947774190	PreciControl ClinChem Multi 2 (4 × 5 mL)	20392
08063494190	Diluent NaCl 9 % (123 mL)	System-ID 2906 001
	General laboratory equipment	

System information

Short name	ACN (application code number)
ALP2	20110

Intended use

In vitro test for the quantitative determination of alkaline phosphatase in human serum and plasma on **cobas** c systems.

Summary

Measurement of alkaline phosphatase with this assay in human serum and plasma is used to aid in the diagnosis and monitoring of liver diseases and bone diseases.

Alkaline phosphatases (EC 3.1.3.1) are membrane-bound ectoenzymes that catalyze the hydrolysis of monophosphates from ester linkage under alkaline conditions (pH 8 to 10).[1] Alkaline phosphatase isoforms are encoded by four different genes: the liver-bone-kidney (tissue-nonspecific) variant, the intestinal variant, the placental variant and the variant from the germ cells (placental-like).[1,2] Alkaline phosphatase activity is present in various tissues, but its concentration varies, and the highest concentrations are typically found in the liver and bone. Although the exact metabolic function of the enzyme is not yet understood, it appears that it is associated with lipid transport in the intestine, with the calcification process in bone, and with host defense through endotoxin dephosphorylation. Minimal amounts of intestinal alkaline phosphatase may also be present and are subjected to increase after a meal.[2]

Total serum alkaline phosphatase measurement is used extensively as a clinical indicator of liver and bone health.[1,2,3,4,5,6,7,8,9] Any form of biliary tree obstruction induces the synthesis of alkaline phosphatase by hepatocytes, therefore a rise in the alkaline phosphatase activity in serum occurs with all forms of cholestasis and particularly with obstructive jaundice.[2,3,4,5] It is also elevated in diseases of the skeletal system associated with increased osteoblastic activity, such as Paget's disease, hyperparathyroidism, rickets and osteomalacia, as well as with fractures and malignant tumors.[1,6,7,8,9,10] A physiologic rise in the alkaline phosphatase activity is sometimes seen in children and juveniles. It is caused by increased osteoblast activity following accelerated bone growth.[1,2,10]

Decreased total alkaline phosphatase activity is rarely found in human serum but can occur in hypophosphatasia, in multiple myeloma with osteolytic lesions, secondary to growth hormone deficiency or in hypoparathyroidism.[1,10]

The assay method was first described by King and Armstrong, modified by Ohmori, Bessey, Lowry and Brock and later improved by Hausamen et al.[11,12,13,14] In 2011 the International Federation of Clinical Chemistry and Laboratory Medicine (IFCC) Scientific Division, Committee on Reference Systems of Enzymes (C-RSE) recommended a reference procedure for the determination of alkaline phosphatase using an optimized substrate concentration and 2-amino-2-methyl-1-propanol as buffer plus the cations magnesium and zinc at 37 °C.[15] This assay follows the recommendations of the IFCC, but was optimized for performance and stability.

Test principle

Reference[15]

Colorimetric assay in accordance with a standardized method.

In the presence of magnesium and zinc ions, p-nitrophenyl phosphate is cleaved by phosphatases into phosphate and p-nitrophenol.

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p-nitrophenyl phosphate + H_2O —ALP→ phosphate + p-nitrophenol

The p-nitrophenol released is directly proportional to the catalytic ALP activity. It is determined by measuring the increase in absorbance.

Reagents

R1	2-amino-2-methyl-1-propanol: 1.724 mol/L, pH 10.44 (30 °C); magnesium acetate: 3.83 mmol/L; zinc sulfate: 0.766 mmol/L; N-(2-hydroxyethyl)-ethylenediamine triacetic acid: 3.83 mmol/L
R3	p-nitrophenyl phosphate: 132.8 mmol/L, pH 8.50 (25 °C); preservatives

R1 is in position B and R3 is in position C.

Warnings and precautions

For in vitro diagnostic use for laboratory 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 safe disposal.

The Safety Data Sheet is available for professional users on request.

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 for all countries: +49-621-7590

Storage and stability

Shelf life at 2-8 °C	See expiration date on **cobas** c pack label.
On-board in use and refrigerated on the analyzer	8 weeks

Calibration

Calibrators	S1: H_2O
	S2: C.f.a.s.
Calibration mode	Linear
Calibration frequency	Full calibration • after reagent lot change

	• as required following quality control procedures

The calibration interval may be extended based on acceptable calibration verification values determined by the laboratory.

Traceability: This method has been standardized against the IFCC procedure (2011).[15]

Quality control

For quality control, use the control materials listed in the “Materials required (but not provided)” section or other suitable control material.

Adjust the limits and control intervals based on the laboratory’s individual requirements. If values fall outside the limits, each laboratory is advised to establish corrective measures.

Follow the applicable government regulations and local guidelines.

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.

Specimens derived from capillary blood were found acceptable.[16]

The sample types listed were tested with a selection of sample collection tubes that were commercially available at the time of testing. 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.

Refer to the "Limitations and interferences" section for details on possible sample interferences.

Stability[17]	7 days at 20-25 °C
	7 days at 4-8 °C
	2 months at -20 °C (± 5 °C)

Freeze only once.

Test procedure

The product is ready for use.

For optimum performance of the assay, follow the instructions given in this document for the corresponding analyzer. For analyzer-specific assay instructions, refer to the corresponding User Guide.

The performance of applications not validated by Roche is not warranted and must be defined by the user.

Application for serum and plasma

Test definition			
Reporting time	10 min		
Wavelength (sub/main)	480/450 nm		
Reagent pipetting		Diluent (H_2O)	
R1	56 µL	19 µL	
R3	13 µL	16 µL	
Sample volumes	*Sample*	*Sample dilution*	
		Sample	*Diluent (NaCl)*
Normal	2.1 µL	–	–
Decreased	2.1 µL	20 µL	80 µL
Increased	2.1 µL	–	–

For further information on the assay test definitions, refer to the application-parameters setting screen of the corresponding analyzer and of the corresponding assay.

Calculation

The **cobas** c systems automatically calculate the analyte activity of each sample in the unit U/L (µkat/L).

Conversion factor:	U/L x 0.0167 = µkat/L

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Limitations and interferences

Criterion: recovery within ± 10 U/L of initial values for samples ≤ 100 U/L and within ± 10 % for samples > 100 U/L.

Icterus:[18] 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:[18] no significant interference up to an H index of 200 (approximate hemoglobin concentration: 124 µmol/L or 200 mg/dL).

Lipemia (Intralipid):[18] no significant interference up to an L index of 2000. There is poor correlation between the L index (corresponds to turbidity) and the triglycerides concentration.

Drugs: No interference was found at therapeutic concentrations using common drug panels.[19,20]

In very rare cases, gammopathy, in particular type IgM (Waldenström's macroglobulinemia), may cause unreliable results.[21]

For diagnostic purposes, always assess the results 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** c systems. All special wash programming necessary for avoiding carryover is available via **cobas** link. The latest version of the carryover evasion list can be found with the NaOHD - SMS - SCCS Method Sheet. For further instructions, refer to the User Guide.

Limits and ranges

Measuring range

5-1200 U/L (0.084-20.0 µkat/L)

Determine samples having higher activities via the rerun function. Dilution of samples via the rerun function is a 1:5 dilution. Results from samples diluted using the rerun function are automatically multiplied by a factor of 5.

Lower limits of measurement

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

Limit of Blank = 5 U/L (0.084 µkat/L)

Limit of Detection = 5 U/L (0.084 µkat/L)

Limit of Quantitation = 5 U/L (0.084 µkat/L)

The Limit of Blank, the Limit of Detection, and the 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 activity 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-activity samples.

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

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

Expected values

U/L

Adults[22]	
Males (n = 221)	40-129 U/L
Females (n = 229)	35-104 U/L

Children[23]	
Males	
Age	
0-14 days	83-248 U/L
15 days-< 1 year	122-469 U/L
1-< 10 years	142-335 U/L
10-< 13 years	129-417 U/L
13-< 15 years	116-468 U/L
15-< 17 years	82-331 U/L

17-< 19 years	55-149 U/L
Females	
Age	
0-14 days	83-248 U/L
15 days-< 1 year	122-469 U/L
1-< 10 years	142-335 U/L
10-< 13 years	129-417 U/L
13-< 15 years	57-254 U/L
15-< 17 years	50-117 U/L
17-< 19 years	45-87 U/L

(measured at 37 °C)

µkat/L*

Adults[22]	
Males (n = 221)	0.67-2.15 µkat/L
Females (n = 229)	0.58-1.74 µkat/L

Children[23]	
Males	
Age	
0-14 days	1.39-4.14 µkat/L
15 days-< 1 year	2.04-7.83 µkat/L
1-< 10 years	2.37-5.59 µkat/L
10-< 13 years	2.15-6.96 µkat/L
13-< 15 years	1.94-7.82 µkat/L
15-< 17 years	1.37-5.53 µkat/L
17-< 19 years	0.92-2.49 µkat/L
Females	
Age	
0-14 days	1.39-4.14 µkat/L
15 days-< 1 year	2.04-7.83 µkat/L
1-< 10 years	2.37-5.59 µkat/L
10-< 13 years	2.15-6.96 µkat/L
13-< 15 years	0.95-4.24 µkat/L
15-< 17 years	0.84-1.95 µkat/L
17-< 19 years	0.75-1.45 µkat/L

*calculated by unit conversion factor

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

Specific performance data

Representative performance data on the analyzers are given below. These data represent the performance of the analytical procedure itself.

Results obtained in individual laboratories may differ from the representative performance data due to heterogeneous sample materials, aging of analyzer components, and mixture of reagents running on the analyzer.

Precision

Precision was determined using human samples and controls in accordance with the CLSI (Clinical and Laboratory Standards Institute) EP05-A3 requirements, with repeatability (n = 84) and intermediate precision (2 aliquots per run, 2 runs per day, 21 days). Results for repeatability and intermediate precision were obtained on the **cobas** c 503 analyzer.

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Repeatability	Mean U/L	SD U/L	CV
PCCC1[A)]	98.9	0.408	0.4
PCCC2[B)]	223	0.673	0.3
Human serum 1	10.2	0.319	3.1
Human serum 2	36.2	0.293	0.8
Human serum 3	144	0.645	0.4
Human serum 4	606	1.27	0.2
Human serum 5	1094	2.66	0.2

A) PreciControl ClinChem Multi 1

B) PreciControl ClinChem Multi 2

Intermediate precision	Mean U/L	SD U/L	CV
PCCC1[A)]	98.4	1.42	1.4
PCCC2[B)]	223	2.83	1.3
Human serum 1	9.27	1.08	11.6
Human serum 2	35.3	1.21	3.4
Human serum 3	144	1.63	1.1
Human serum 4	607	3.30	0.5
Human serum 5	1095	5.21	0.5

A) PreciControl ClinChem Multi 1

B) PreciControl ClinChem Multi 2

The data obtained on the **cobas** c 503 analyzer are representative for the **cobas** c 303 analyzer and the **cobas** c 703 analyzer.

Method comparison

Alkaline phosphatase values for human serum and plasma samples obtained on a **cobas** c 503 analyzer (y) were compared with those determined using the corresponding reagent on a **cobas** c 501 analyzer (x).

Sample size (n) = 88

Passing/Bablok[24]	Linear regression
y = 0.987x – 1.24 U/L	y = 1.013x – 4.31 U/L
τ = 0.985	r = 1.000

The sample activities were between 15.0 and 1171 U/L.

Alkaline phosphatase values for human serum and plasma samples obtained on a **cobas** c 303 analyzer (y) were compared with those determined using the corresponding reagent on a **cobas** c 501 analyzer (x).

Sample size (n) = 75

Passing/Bablok[24]	Linear regression
y = 0.985x – 0.691 U/L	y = 0.996x – 3.04 U/L
τ = 0.994	r = 1.000

The sample activities were between 15.8 and 1177 U/L.

Alkaline phosphatase values for human serum and plasma samples obtained on a **cobas** c 703 analyzer (y) were compared with those determined using the corresponding reagent on a **cobas** c 503 analyzer (x).

Sample size (n) = 75

Passing/Bablok[24]	Linear regression
y = 1.010x – 0.171 U/L	y = 1.019x – 1.18 U/L
τ = 0.999	r = 1.000

The sample concentrations were between 7.10 and 1129 U/L.

Additional information

Additions, deletions, or changes are indicated by a change bar in the margin.

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A point (period/stop) is always used in the English version of a Method Sheet as the decimal separator to mark the boundary between the integral and the fractional parts of a decimal numeral. The translated Method Sheets use decimal commas. Labels only use the decimal point as separator. Separators for thousands are not used.

Report any serious incident that has occurred in relation to the device to the manufacturer and the competent authority of the member state in which the user and/or patient is established.

Symbols

In addition to the ISO 15223-1 standard, Roche Diagnostics uses the following symbols and signs:

CONTENT	Contents of kit
→	Volume for reconstitution
GTIN	Global Trade Item Number
Rx only	For USA: Caution: Federal law restricts this device to sale by or on the order of a physician.

References

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Change log

For this document version only:

Due to technical reasons, changes that have been made since the last version of this document are listed in the following table instead of indicated by change bars in the margin.

Section headers are indicated in bold letters.

In addition to the changes listed in the table below, this method sheet version contains several editorial and layout updates.

Section	Current version	Previous version
Materials provided	**Materials provided**	**Order information** **Materials provided**
Materials provided	**Materials provided** without System-ID	**Order information** with System-ID
Materials required (but not provided)	**Materials required (but not provided)**	**Order information** **Materials required (but not provided)**
Reagents	**Reagents**	**Reagents - working solutions**
Warnings and precautions	**Warnings and precautions**	**Precautions and warnings**
Specimen collection and preparation	Specimens derived from capillary blood were found acceptable. [Collier BB et al.]	
Test procedure	**Test procedure**	**Reagent handling** **Assay**
Limitations and interferences	**Limitations and interferences**	**Limitations - interference**
Additional information	**Additional information**	
Additional information	A point (period/stop) is always used in the English version of a Method Sheet as the decimal separator to mark the boundary between the integral and the fractional parts of a decimal numeral. The translated Method Sheets use decimal commas. Labels only use the decimal point as separator. Separators for thousands are not used.	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.
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