



# Elecsys Vitamin D total III

cobas®

REF			SYSTEM
09038086190	09038086501	300	cobas e 402 cobas e 801

## English

For use in the USA only

## System information

Short name	ACN (application code number)
VITDT 3	10194

## Intended use

Binding assay for the in vitro quantitative determination of total 25-hydroxyvitamin D in human serum and plasma. This assay is to be used as an aid in the assessment of vitamin D sufficiency in adults.

The electrochemiluminescence binding assay is intended for use on **cobas e** immunoassay analyzers.

## Summary

Vitamin D is a fat-soluble steroid hormone precursor that is mainly produced in the skin by exposure to sunlight. Vitamin D is biologically inert and must undergo 2 successive hydroxylations in the liver and kidney to become the biologically active 1,25-dihydroxyvitamin D.<sup>1</sup>

The 2 most important forms of vitamin D are vitamin D<sub>3</sub> (cholecalciferol) and vitamin D<sub>2</sub> (ergocalciferol). In contrast to vitamin D<sub>3</sub>, the human body cannot produce vitamin D<sub>2</sub> which is taken up with fortified food or given by supplements. In blood vitamin D<sub>3</sub> and D<sub>2</sub> are bound to the vitamin D binding protein (VDBP) and transported to the liver where both are hydroxylated to form 25-hydroxyvitamin D. It is commonly agreed that 25-hydroxyvitamin D is the metabolite to determine the overall vitamin D status as it is the major storage form of vitamin D in the human body. This primary circulating form of vitamin D is biologically inactive with levels approximately 1000-fold greater than the circulating 1,25-dihydroxyvitamin D. The half-life of circulating 25-hydroxyvitamin D is 2-3 weeks.

Most of the 25-hydroxyvitamin D, measurable in blood circulation, is 25-hydroxyvitamin D<sub>3</sub> whereas 25-hydroxyvitamin D<sub>2</sub> reaches measurable levels only in patients taking vitamin D<sub>2</sub> supplements.<sup>2,3,4</sup> Vitamin D<sub>2</sub> is considered to be less effective.<sup>5</sup>

The most abundant product of 25-hydroxyvitamin D catabolism by 24-hydroxylase (CYP24A1) is 24,25-dihydroxyvitamin D.<sup>6</sup> It accounts for 2-20 % of the total circulating 25-hydroxyvitamin D, has a half-life of approximately 7 days and is present in blood circulation at concentrations of up to approximately 10 nmol/L.<sup>6,7,8</sup>

The C-3 epimer of 25-hydroxyvitamin D<sub>3</sub> forms as a result of epimerization of 25(OH)D<sub>3</sub>.<sup>9</sup> It has been reported to contribute up to 55-61 % to the 25-hydroxyvitamin D status of newborns and infants.<sup>10,11</sup> It may also be detectable in adult circulation, though it has been reported to make a relatively small contribution of up to 3-6 % of total 25-hydroxyvitamin D concentration.<sup>12,13,14,15,16,17</sup>

Vitamin D is essential for bone health. In children, severe deficiency leads to bone-malformation, known as rickets. Milder degrees of insufficiency are believed to cause reduced efficiency in the utilization of dietary calcium.<sup>18</sup> Vitamin D deficiency causes muscle weakness; in elderly, the risk of falling has been attributed to the effect of vitamin D on muscle function.<sup>19</sup>

Vitamin D deficiency is a common cause of secondary hyperparathyroidism.<sup>20,21</sup> Elevations of parathyroid hormone levels, especially in elderly vitamin D deficient adults can result in osteomalacia, increased bone turnover, reduced bone mass and risk of bone fractures.<sup>22</sup> Low 25-hydroxyvitamin D concentrations are also associated with lower bone mineral density.<sup>23</sup> In conjunction with other clinical data, the results may be used as an aid in the assessment of bone metabolism.

So far, vitamin D has been shown to affect expression of over 200 different genes. Insufficiency has been linked to diabetes, different forms of cancer, cardiovascular disease, autoimmune diseases, respiratory diseases and innate immunity.<sup>2</sup>

The Elecsys Vitamin D total III assay employs a VDBP labeled with a ruthenium complex<sup>a)</sup> as capture protein to bind 25-hydroxyvitamin D<sub>3</sub> and 25-hydroxyvitamin D<sub>2</sub>. Cross-reactivity to 24,25-dihydroxyvitamin D is blocked by a specific monoclonal antibody.

a) Tris(2,2'-bipyridyl)ruthenium(II)-complex (Ru(bpy)<sub>3</sub><sup>2+</sup>)

## Test principle

Competition principle. Total duration of assay: 27 minutes.

- 1st incubation: By incubating the sample (9 µL) with pretreatment reagent 1 and 2, bound 25-hydroxyvitamin D is released from the VDBP.
- 2nd incubation: By incubating the pretreated sample with the ruthenium labeled VDBP, a complex between the 25-hydroxyvitamin D and the ruthenylated VDBP is formed.

A specific unlabeled antibody binds to 24,25-dihydroxyvitamin D present in the sample and inhibits cross-reactivity to this vitamin D metabolite.

- 3rd incubation: After addition of streptavidin-coated microparticles and 25-hydroxyvitamin D labeled with biotin, unbound ruthenylated labeled VDBP become occupied. A complex consisting of the ruthenylated VDBP and the biotinylated 25-hydroxyvitamin D is formed and becomes bound to the solid phase via interaction of biotin and streptavidin.
- The reaction mixture is aspirated into the measuring cell where the microparticles are magnetically captured onto the surface of the electrode. Unbound substances are then removed with ProCell II M. Application of a voltage to the electrode then induces chemiluminescent emission which is measured by a photomultiplier.
- Results are determined via a calibration curve which is instrument-specifically generated by 2-point calibration and a master curve provided via the **cobas** link.

## Reagents - working solutions

The **cobas e** pack (M, R1, R2) and the pretreatment reagents (PT1, PT2) are labeled as VITDT 3.

PT1 Pretreatment reagent 1, 1 bottle, 7.3 mL:  
Dithiothreitol 1 g/L, pH 5.5.

PT2 Pretreatment reagent 2, 1 bottle, 6.3 mL:  
Sodium hydroxide 57.5 g/L.

M Streptavidin-coated microparticles, 1 bottle, 12.4 mL:  
Streptavidin-coated microparticles 0.72 mg/mL; preservative.

R1 Vitamin D binding protein-Ru(bpy)<sub>3</sub><sup>2+</sup>, 1 bottle, 18.8 mL:  
Ruthenium labeled vitamin D binding protein 150 µg/L; bis-tris propane buffer 200 mmol/L; albumin (human) 25 g/L; pH 7.5; preservative.

R2 25-hydroxyvitamin D-biotin, 1 bottle, 15.8 mL:  
Biotinylated 25-hydroxyvitamin D 20 µg/L; bis-tris propane buffer 200 mmol/L; pH 8.6; preservative.

## Precautions and warnings

For in vitro diagnostic use for healthcare 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.

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



Danger

H290



May be corrosive to metals.

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H314 Causes severe skin burns and eye damage.

H317 May cause an allergic skin reaction.

## Prevention:

P261 Avoid breathing mist or vapours.

P280 Wear protective gloves/ protective clothing/ eye protection/ face protection/ hearing protection.

## Response:

P301 + P330 IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.  
+ P331

P303 + P361 IF ON SKIN (or hair): Take off immediately all contaminated  
+ P353 clothing. Rinse skin with water.

P304 + P340 IF INHALED: Remove person to fresh air and keep  
+ P310 comfortable for breathing.  
Immediately call a POISON CENTER/ doctor.

P305 + P351 IF IN EYES: Rinse cautiously with water for several  
+ P338 minutes. Remove contact lenses, if present and easy to do.  
+ P310 Continue rinsing. Immediately call a POISON CENTER/  
doctor.

Product safety labeling follows EU GHS guidance.

Contact phone: 1-800-428-2336

All human material should be considered potentially infectious. All products derived from human blood are prepared exclusively from the blood of donors tested individually and shown to be free from HBsAg and antibodies to HCV and HIV. The testing methods use assays that have been approved or cleared by the FDA or that are in compliance with the legal rules of the European Union (IVDR 2017/746/EU, IVDD 98/79/EC, Annex II, List A). However, as no testing method can rule out the potential risk of infection with absolute certainty, the material should be handled with the same level of care as a patient specimen. In the event of exposure, the directives of the responsible health authorities should be followed.<sup>24,25</sup>

Avoid foam formation in all reagents and sample types (specimens, calibrators and controls).

## Reagent handling

The reagents in the kit have been assembled into a ready-for-use unit that cannot be separated.

All information required for correct operation is available via the **cobas** link.

## Storage and stability

Store at 2-8 °C.

Do not freeze.

Store the **cobas e** pack **upright** in order to ensure complete availability of the microparticles during automatic mixing prior to use.

Stability:	
unopened at 2-8 °C	up to the stated expiration date
on the analyzers	11 weeks

## Specimen collection and preparation

Only the specimens listed below were tested and found acceptable.

Serum collected using standard sampling tubes or tubes containing separating gel.

Li-heparin, K<sub>2</sub>-EDTA and K<sub>3</sub>-EDTA plasma.

Plasma tubes containing separating gel can be used.

Criterion: Slope 0.9-1.1 + coefficient of correlation  $\geq 0.95$  and within a bias  $\leq \pm 15\%$  at the medical decision point (30 ng/mL).

Stable for 8 hours at 20-25 °C, 4 days at 2-8 °C, 24 weeks at -20 °C ( $\pm 5$  °C).

Freeze only once.

The sample types listed were tested with a selection of sample collection tubes or systems that were commercially available at the time of testing, i.e. not all available tubes of all manufacturers were tested. 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/collection system manufacturer.

Adapt preanalytics protocol if required.

Centrifuge samples containing precipitates before performing the assay.

Do not use heat-inactivated samples.

Do not use samples and controls stabilized with azide.

Ensure the samples, calibrators and controls are at 20-25 °C prior to measurement.

Due to possible evaporation effects, samples, calibrators and controls on the analyzers should be analyzed/measured within 2 hours.

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)

- [REF] 09038116190, CalSet Vitamin D total III, for 4 x 1.0 mL
- [REF] 09038124190, PreciControl Vitamin D total III, for 6 x 1.0 mL
- [REF] 07299001190, Diluent Universal, 36 mL sample diluent
- General laboratory equipment
- **cobas e** analyzer

Additional materials for **cobas e** 402 and **cobas e** 801 analyzers:

- [REF] 06908799190, ProCell II M, 2 x 2 L system solution
- [REF] 04880293190, CleanCell M, 2 x 2 L measuring cell cleaning solution
- [REF] 07485409001, Reservoir Cup, 8 cups to supply ProCell II M and CleanCell M
- [REF] 06908853190, PreClean II M, 2 x 2 L wash solution
- [REF] 05694302001, Assay Tip/Assay Cup tray, 6 magazines x 6 magazine stacks x 105 assay tips and 105 assay cups, 3 wasteliners
- [REF] 07485425001, Liquid Flow Cleaning Cup, 2 adaptor cups to supply ISE Cleaning Solution/Elecsys SysClean for Liquid Flow Cleaning Detection Unit
- [REF] 07485433001, PreWash Liquid Flow Cleaning Cup, 1 adaptor cup to supply ISE Cleaning Solution/Elecsys SysClean for Liquid Flow Cleaning PreWash Unit
- [REF] 11298500160, ISE Cleaning Solution/Elecsys SysClean, 5 x 100 mL system cleaning solution (for USA)

## 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.

Resuspension of the microparticles takes place automatically prior to use.

Place the cooled (stored at 2-8 °C) **cobas e** pack on the reagent manager. Avoid foam formation. The system automatically regulates the temperature of the reagents and the opening/closing of the **cobas e** pack.

## Calibration

Traceability: This method has been standardized using internal standards which are traceable to the ID-LC-MS/MS 25-hydroxyvitamin D Reference Measurement Procedure.<sup>26,27</sup> The ID-LC-MS/MS is traceable to the National Institute of Standards and Technology Standard Reference Material 2972.<sup>28</sup>

The predefined master curve is adapted to the analyzer using the relevant CalSet.

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**Calibration frequency:** Calibration must be performed once per reagent lot using fresh reagent (i.e. not more than 24 hours since the **cobas e** pack was registered on the analyzer).

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

Renewed calibration is recommended as follows:

- after 11 weeks when using the same reagent lot
- after 28 days when using the same **cobas e** pack on the analyzer
- as required: e.g. quality control findings outside the defined limits

## Quality control

Use PreciControl Vitamin D total III or other suitable controls for routine quality control procedures.

Controls for the various concentration ranges should be run individually at least once every 24 hours when the test is in use, once per **cobas e** pack, and following each calibration.

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.

If necessary, repeat the measurement of the samples concerned.

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

## Calculation

The analyzer automatically calculates the analyte concentration of each sample (either in ng/mL or nmol/L).

Conversion factors:  $\text{nmol/L} \times 0.40 = \text{ng/mL}$   
 $\text{ng/mL} \times 2.50 = \text{nmol/L}$

## Limitations - interference

The effect of the following endogenous substances and pharmaceutical compounds on assay performance was tested. Interferences were tested up to the listed concentrations and no impact on results was observed.

### Endogenous substances

Compound	Concentration tested
Bilirubin	$\leq 1129 \mu\text{mol/L}$ or $\leq 66 \text{ mg/dL}$
Hemoglobin	$\leq 0.373 \text{ mmol/L}$ or $\leq 600 \text{ mg/dL}$
Intralipid	$\leq 300 \text{ mg/dL}$
Biotin	$\leq 2456 \text{ nmol/L}$ or $\leq 600 \text{ ng/mL}$
Rheumatoid factors	$\leq 1200 \text{ IU/mL}$
Serum albumin	$\leq 7 \text{ g/dL}$
IgG	$\leq 7 \text{ g/dL}$
IgA	$\leq 1.3 \text{ g/dL}$
IgM	$\leq 1 \text{ g/dL}$
Triglyceride	$\leq 300 \text{ mg/dL}$

Criterion:  $\pm 2.5 \text{ ng/mL}$  of initial value for samples  $\leq 20.0 \text{ ng/mL}$ , within  $\pm 10 \%$  of initial value for samples  $> 20.0 \text{ ng/mL}$  to  $50.0 \text{ ng/mL}$  and within  $\pm 15 \%$  of initial value for samples  $> 50.0 \text{ ng/mL}$ .

Pharmacokinetic studies have shown that serum concentrations of biotin can reach up to  $355 \text{ ng/mL}$  within the first hour after biotin ingestion for subjects consuming supplements of  $20 \text{ mg}$  biotin per day and up to  $656 \text{ ng/mL}$  or  $1160 \text{ ng/mL}$  for subjects after a single dose of  $100 \text{ mg}$  or  $300 \text{ mg}$  biotin, respectively.<sup>29,30,31</sup>

Specimens containing biotin up to a concentration of  $600 \text{ ng/mL}$  demonstrated  $\leq 10 \%$  change in 25-hydroxyvitamin D assay results. For biotin concentrations greater than this, the deviations in the table below have to be expected.

Sample (ng/mL)			Biotin concentration (ng/mL)						
			155	310	620	930	1240	1395	1550
Low	9.80	Absolute deviation	0.453	0.484	2.05	2.63	3.63	4.18	4.67
Mid	28.3	Relative deviation	3 %	4 %	8 %	11 %	12 %	15 %	16 %
High	77.0		-1 %	-2 %	-1 %	-2 %	-2 %	-1 %	-2 %

### Pharmaceutical substances

In vitro tests were performed on 17 commonly used pharmaceuticals. No interference with the assay was found.

Drug	Concentration tested mg/L
Acetylcysteine	150
Acetylsalicylic acid	30
Ampicillin-Na	75
Ascorbic acid	52.5
Cefoxitin	750
Doxycycline	18
Heparin	3300 IU/L
Levodopa	7.5
Methyldopa	22.5
Metronidazole	123
Rifampicin	48
Acetaminophen	156
Cyclosporine	1.8
Ibuprofen	219
Theophylline	60
Phenylbutazone	321
Itraconazole	30

In addition, the following special drugs were tested. No interference with the assay was found.

### Special drugs

Drug	Concentration tested mg/L
EinsAlpha (alfacalcidol)	0.0018
ZEMPLAR (paricalcitol)	0.0012
Rocaltrol (calcitriol)	0.0010

Drug interferences are measured based on recommendations given in CLSI guidelines EP07 and EP37 and other published literature. Effects of concentrations exceeding these recommendations have not been characterized.

In rare cases, interference due to extremely high titers of antibodies to analyte-specific antibodies, streptavidin or ruthenium can occur. These effects are minimized by suitable test design.

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

## Limits and ranges

### Measuring range

$6.00\text{--}120 \text{ ng/mL}$  or  $15.0\text{--}300 \text{ nmol/L}$  (defined by the Limit of Quantitation and the maximum of the master curve). Values below the Limit of Quantitation are reported as  $< 6.00 \text{ ng/mL}$  ( $< 15.0 \text{ nmol/L}$ ). Values above the measuring range are reported as  $> 120 \text{ ng/mL}$  ( $> 300 \text{ nmol/L}$ ) or up to  $240 \text{ ng/mL}$  ( $600 \text{ nmol/L}$ ) for 2-fold diluted samples.

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## Lower limits of measurement

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

Limit of Blank = 2.0 ng/mL (5.0 nmol/L)

Limit of Detection = 3.0 ng/mL (7.5 nmol/L)

Limit of Quantitation = 6.0 ng/mL (15.0 nmol/L)

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 95<sup>th</sup> percentile value from  $n \geq 60$  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 an intermediate precision CV of  $\leq 20$  %.

## Dilution

Samples with 25-hydroxyvitamin D concentrations above the measuring range can be diluted with Diluent Universal. The recommended dilution is 1:2. The concentration of the diluted sample must be  $\geq 40$  ng/mL ( $\geq 100$  nmol/L).

After dilution by the analyzers, the software automatically takes the dilution into account when calculating the sample concentration.

## Expected values

Due to different standardizations between methods, result variation may arise.

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

Clinical assessment should be taken into consideration when interpreting results. It should be taken into consideration that differences in 25-hydroxyvitamin D levels may exist with respect to gender, age, season, geographical latitude and ethnic groups.<sup>32,33</sup>

Currently there is no standard definition of the optimal vitamin D status. Most experts agree that vitamin D deficiency should be defined as 25-hydroxyvitamin D of  $\leq 20$  ng/mL ( $\leq 50$  nmol/L).<sup>32</sup> Vitamin D insufficiency is recognized as 21-29 ng/mL.<sup>32</sup> Similarly, the US National Kidney Foundation considers levels  $< 30$  ng/mL to be insufficient or deficient.<sup>34</sup> The preferred level for 25-hydroxyvitamin D by many experts is now recommended to be  $\geq 30$  ng/mL ( $\geq 75$  nmol/L).<sup>32,33,35,36</sup> Other clinical references may show different values.

A reference range study was conducted with samples from apparently healthy donors from the United States. Samples were collected from southern, middle and northern sites in summer and winter. There were approximately equal numbers of males and females, and approximately 30 % of the donors had dark complexion. The age range was 22 to 79 years.

The values given are for information only and may vary from other published data.

	Season					
	All (n = 463)		Summer (n = 245)		Winter (n = 218)	
Unit	ng/mL	nmol/L	ng/mL	nmol/L	ng/mL	nmol/L
Mean	26.6	66.5	29.2	73.1	23.6	59.1
Median	25.7	64.1	27.7	69.2	22.8	57.1
2.5 <sup>th</sup> percentile	10.2	25.4	12.5	31.3	9.38	23.5
97.5 <sup>th</sup> percentile	49.4	123	52.4	131	44.1	110

## Specific performance data

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

## Precision

Precision was determined using Elecsys reagents, samples and controls in a protocol (EP05-A3) of the CLSI (Clinical and Laboratory Standards Institute): 2 runs per day in duplicate each for 21 days ( $n = 84$ ). The following results were obtained:

cobas e 402 and cobas e 801 analyzers					
Sample	Repeatability				
	Mean		SD		CV
	ng/mL	nmol/L	ng/mL	nmol/L	%
HS <sup>b)</sup> 1	7.88	19.7	0.498	1.25	6.3
HS 2	19.2	48.0	0.483	1.21	2.5
HS 3	29.3	73.3	0.864	2.16	3.0
HS 4	59.3	148	0.931	2.33	1.6
HS 5	112	280	1.42	3.55	1.3
PC <sup>c)</sup> Vitamin D total III 1	20.2	50.5	0.643	1.61	3.2
PC Vitamin D total III 2	38.2	95.5	0.790	1.98	2.1

b) HS = human serum

c) PC = PreciControl

cobas e 402 and cobas e 801 analyzers					
Sample	Intermediate precision				
	Mean		SD		CV
	ng/mL	nmol/L	ng/mL	nmol/L	%
HS <sup>b)</sup> 1	7.88	19.7	0.698	1.75	8.9
HS 2	19.2	48.0	0.883	2.21	4.6
HS 3	29.3	73.3	1.14	2.85	3.9
HS 4	59.3	148	1.42	3.55	2.4
HS 5	112	280	1.73	4.33	1.5
PC <sup>c)</sup> Vitamin D total III 1	20.2	50.5	0.946	2.37	4.7
PC Vitamin D total III 2	38.2	95.5	1.10	2.75	2.9

## Method comparison

a) A comparison of the Elecsys Vitamin D total III assay (y) using the CDC Verification Samples with concentrations assigned by the CDC Vitamin D Reference Laboratory by ID-LC-MS/MS (x) gave the following correlations (ng/mL):

Number of samples measured: 158

Deming<sup>37,38</sup>

$$y = 0.915x + 0.734$$

$$r = 0.979$$

Passing Bablok<sup>39</sup>

$$y = 0.926x + 0.198$$

$$\tau = 0.902$$

The sample concentrations were between 5.64 ng/mL (14.1 nmol/L) and 133 ng/mL (332.5 nmol/L).

b) A comparison of the Elecsys Vitamin D total III assay, [REF] 09038086190 (cobas e 801 analyzer; y) with the Elecsys Vitamin D total III assay, [REF] 09038078160 (cobas e 601 analyzer; x) gave the following correlations (ng/mL):

Number of samples measured: 157

Passing Bablok<sup>39</sup>

$$y = 0.952x - 0.850$$

$$r = 0.992$$

The sample concentrations were between 8.68 ng/mL (21.7 nmol/L) and 109 ng/mL (273 nmol/L).

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## Analytical specificity

A study was performed based on guidance from CLSI EP07-A2 to evaluate the cross-reactivity of the assay with other vitamin D metabolites. Samples containing the cross-reactants were prepared at 3 25-hydroxyvitamin D concentrations (25, 40 and 60 ng/mL). The % cross-reactivity was calculated for each sample using the equation below and normalized to the cross-reactivity of 25-hydroxyvitamin D<sub>3</sub>.<sup>40</sup>

$$\% \text{ cross-reactivity} = \frac{(\text{mean conc. of spiked sample} - \text{mean conc. of unspiked sample})}{\text{spiked concentration}} \times 100 \%$$

(non-normalized)

The mean results from this study are summarized in the following table:

Cross-reactant	Concentration added ng/mL	Non-normalized mean cross-reactivity %	Normalized mean cross-reactivity %
25-hydroxyvitamin D <sub>3</sub>	50	72.2	100.0
25-hydroxyvitamin D <sub>2</sub>	50	75.7	105.0
24,25-dihydroxy-vitamin D <sub>3</sub>	100	5.8	8.1
3-epi-25-hydroxy-vitamin D <sub>3</sub>	50	88.2	122.4
3-epi-25-hydroxy-vitamin D <sub>2</sub>	50	74.7	103.6
1,25-dihydroxy-vitamin D <sub>3</sub>	100	n.d. <sup>d)</sup>	n.d. <sup>d)</sup>
1,25-dihydroxy-vitamin D <sub>2</sub>	100	0.3	0.4
Vitamin D <sub>3</sub>	1000	0.6	0.8
Vitamin D <sub>2</sub>	1000	0.5	0.7

d) n.d. = not detectable

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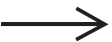

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