



## **Rat-MID™ Osteocalcin EIA**

Enzymeimmunoassay for the quantitative determination of  
osteocalcin in rat serum and plasma

*For Research Use Only. Not for use in diagnostic procedures*

REF

AC-12F1



96

## INTRODUCTION

### Intended use

The Rat-MID™ Osteocalcin EIA is an enzyme-linked immunosorbent assay for the quantitative determination of osteocalcin in rat serum and plasma. The assay is for research-use-only.

### Summary and explanation of the test

Osteocalcin or bone Gla protein (BGP), is a major non-collagenous protein of the bone matrix. It has a molecular weight of approximately 6000 Dalton and consists in most species of 49 amino acids; however, rat osteocalcin consists of 50 amino acids (1-4). Osteocalcin has a unique property for binding to calcium facilitated by the presence of 2-3 gamma-carboxyglutamic acids at position 17, 21 and 24 (5). The mid-molecular part of osteocalcin, especially the amino acids between 20 and 30, exhibits a high degree of inter-species conservatism (4).

The bone forming cells, osteoblasts, synthesizes osteocalcin. After production it is partly incorporated into the bone matrix and partly delivered to the circulatory system. Circulating osteocalcin is associated with changes in the rate of bone turnover and regarded as a specific marker for bone formation (4).

The clinical utility of rat osteocalcin as a marker for bone turnover has been evaluated in several pre-clinical settings. It has been reported that the serum level increases after ovariectomy and this estrogen-deficiency-induced state can be prevented by treatment with either estrogen, selective estrogen receptor modulators (SERMs) or bisphosphonates (6-10).

### Principle of the procedure

The Rat-MID™ Osteocalcin EIA is based upon the competitive binding of a monoclonal antibody to soluble osteocalcin or to immobilized osteocalcin. Briefly, the monoclonal antibody is raised against human osteocalcin and recognizes the mid-molecular part (amino acids 21-29) of the molecule (11). Synthetic human osteocalcin is used for standardization. Parallelism is observed with purified rat osteocalcin and rat serum.

During the Pre-incubation step, biotinylated osteocalcin is immobilized by binding to the streptavidin-coated microtitre wells. The wells are emptied and washed, and standards, control, or unknown serum samples are pipetted into appropriate wells, followed by a solution of monoclonal antibody. Following the Primary-incubation step the wells are emptied and washed. In the Secondary-incubation step a solution of peroxidase conjugated anti-mouse immunoglobulins is added and binds to the monoclonal antibody. After the third washing step a chromogenic substrate (TMB) is added and the colour reaction is stopped with sulfuric acid. Finally, the absorbance at 450 nm is measured. The absorbance level is inversely related to concentration of osteocalcin in the sample.

## PRECAUTIONS

### Storage

Store the package upon receipt at 2-8°C. Under these conditions the reagents are stable up to the expiry date stated on each vial.

Following reconstitution the Standards and the Control should be stored below -18°C, and should only be frozen and thawed twice. When Primary antibody and the Primary Incubation Buffer have been mixed, the remaining solution should be stored at 2-8°C for maximum 30 days or below -18°C. The remaining reagents and immunostrips should be stored at 2-8°C.

#### Note:

The specimens' storage and stability information stated above are general recommendations for use in a variety of settings of laboratories. Each laboratory should follow the guidelines or requirements of local, state, and/or federal regulations or accrediting organizations to establish its own specimens handling and storage stability. For guidance on appropriate practices, please refer to the CLSI GP44-A4, Procedures for the Handling and Processing of Blood Specimens for Common Laboratory Tests; Approved Guideline - Fourth Edition

## Warnings

The Rat-MID™ Osteocalcin EIA is for research-use-only and is not for internal use in humans or animals. This product must be used strictly in accordance with the instructions set out in the Package Insert.

Immunodiagnostic Systems Limited will not be held responsible for any loss or damage (except as required by statute) howsoever caused, arising out of non-compliance with the instructions provided.

**CAUTION:** this kit contains material of animal origin. Handle kit reagents as if capable of transmitting an infectious agent.

## Sodium Azide

Some reagents in this kit contain sodium azide as a preservative, which may react with lead, copper or brass plumbing to form highly explosive metal azides. On disposal, flush with large volumes of water to prevent azide build up.

Calibrators **CAL** and Controls **CTRL** contain sodium azide ( $\text{NaN}_3$ ) >0.1% (w/w) (<1%).

### Classification according to Regulation (EC) CLP:

Acute toxicity (oral), Category 4  
Hazardous to the aquatic environment – Chronic Hazard, Category 3



Warning

Contains Sodium Azide

### Hazard statements:

H302 - Harmful if swallowed.  
H412 - Harmful to aquatic life with long lasting effects.

### Precautionary statements

P264 - Wash hands, forearms and face thoroughly after handling.

Appropriate precautions and good laboratory practices must be used in the storage, handling and disposal of the kit reagents. Disposal of kit reagents should be in accordance with local regulations.

Do not use reagents beyond their expiration date and do not mix reagents from different lots of kits.

## MATERIAL

### Specimen collection

When collecting blood take care to avoid haemolysis. Separate the serum from the cells within 3 hours after collection of blood. It is recommended to freeze (<-18°C) samples immediately after use.

### Materials supplied

Before opening the kit, please read the section on Precautions. The kit contains reagents sufficient for 96 determinations.

### Streptavidin coated microtitre plate **MICROPLAT**

Microwell strips (12 x8 wells) pre-coated with streptavidin. Supplied in a plastic frame.

### Osteocalcin Standard **CAL 0**

One vial (lyophilized) containing a PBS-buffered solution with protein stabilizer and preservative. Reconstitute with 5.0 mL of distilled water. The standard must be stored at or below -18°C after use.

### Osteocalcin Standards **CAL 1 - 5**

Five vials (lyophilized) containing synthetic human osteocalcin in a PBS-buffered solution with protein stabilizer and preservative. Reconstitute each of the vials with 0.5 mL of distilled water. The standard must be stored below -18°C after use, and must only be frozen and thawed twice. The exact value of each standard is printed on the Quality Control Report.

### Control **CTRL**

One vial (lyophilized) containing synthetic human osteocalcin in a PBS-buffered solution with protein stabilizer and preservative. Reconstitute with 0.5 mL of distilled water. The control must be stored below -18°C after use, and must only be frozen and thawed twice. Please refer to the enclosed QC Report for control range.

### Biotinylated Osteocalcin **AG BIOTIN**

One vial (min. 12.0 mL) of a ready for use solution containing biotinylated synthetic human osteocalcin in a PBS-buffered solution with protein stabilizer and preservative.

**Primary Antibody** AB

One vial (0.5 mL) of a concentrated solution of a monoclonal antibody specific the mid-molecular part (amino acids 21-29) of osteocalcin, in a buffered solution with protein stabilizer and preservative.

**Primary Incubation Buffer** BUF

One vial (20.0 mL) of a ready-for-use PBS-buffered solution with protein stabilizer, detergent and preservative for dilution of Primary Antibody.

**Secondary Antibody** ENZYMCONJ

One vial (12.0 mL) of a ready-for-use solution of a peroxidase conjugated antibody specific for mouse IgG in a buffered solution with protein stabilizer and preservative.

**Substrate Solution** SUBS TMB

One vial (12.0 mL) of a ready-for-use tetramethylbenzidine (TMB) substrate in an acidic solution.

**Stopping Solution** H<sub>2</sub>SO<sub>4</sub>

One vial (12.0 mL) of ready-for-use 0.18 M sulfuric acid.

**Washing Solution** WASHBUF 50X

One vial (20.0 mL) of a concentrated washing solution containing detergent and preservative. Dilute 1+50 in distilled water before use.

**Sealing tape**

Adhesive film for covering wells during incubation.

**Materials required – not supplied**

- Containers for preparing the dilutions of the Primary Antibody and the Washing Solution
- Precision micropipettes to deliver 20 µL
- Distilled water
- Precision 8 or 12-channel multipipette to deliver 100 µL and 150 µL
- Microtitre plate mixing apparatus (300 rpm)
- ELISA plate reader with both 450 nm and 650 nm filters

**ASSAY PROCEDURE**

Prior to use, equilibrate all solutions to room temperature. Perform the assay at room temperature (18-22°C). Determine the number of strips needed for the entire experiment. It is recommended to test all samples in duplicate. In addition, for each ELISA plate 14 wells are recommended for standards and 2 wells are recommended for the Control.

**1. Pre-incubation**

Add 100 µL of Biotinylated Osteocalcin AG BIOTIN to each well, cover with sealing tape, and incubate for 30±5 minutes at room temperature (18-22°C) on a microtitre plate mixing apparatus (300 rpm).

**2. Washing**

Wash the immuno strips 5 times manually with 300 µL Washing Solution. Make sure that the wells are completely emptied after each washing cycle. Using an automated plate washer, follow the instructions of the manufacturer or the guidelines of the laboratory. Usually 5 washing cycles are adequate.

**3. Primary incubation**

A: Prior to use mix the Primary Antibody AB and Primary Incubation Buffer BUF in the volumetric ratio 1+100 in an empty container. Mix carefully and avoid formation of foam.

B: 20 µL of either Standards CAL 0 - 5, Control CTRL or unknown samples are pipetted into appropriate wells followed by 150 µL of the mixture of Primary Antibody in Primary Incubation Buffer. Cover the immuno strips with sealing tape and incubate for 60±5 minutes at room temperature (18-22°C) on a microtitre plate mixing apparatus (300 rpm).

**4. Washing**

See step 2

**5. Secondary incubation**

Add 100 µL of the Secondary Antibody ENZYMCONJ to each well, cover with sealing tape, and incubate

for 60±5 minutes at room temperature (18-22°C) on a microtitre plate mixing apparatus (300 rpm).

#### 6. Washing

See step 2

#### 7. Incubation with chromogenic substrate solution

Pipette 100 µL of the Substrate Solution [SUBS TMB] into each well and incubate for 15±2 minutes at room temperature (18-22°C) in the dark on the microtitre plate mixing apparatus (300 rpm). Use sealing tape.

#### 8. Stopping of colour reaction

Pipette 100 µL of the Stopping Solution [H<sub>2</sub>SO<sub>4</sub>] into each well.

#### 9. Measurement of absorbance

The absorbance is measured within two hour at 450 nm. It is recommended to use the reading at 650 nm as reference.

#### Limitations of the procedure

If the absorbance of a sample is lower than Standard 5, it is recommended to dilute the sample to be diluted in rat serum with a low osteocalcin concentration.

## QUALITY CONTROL

Good Laboratory Practice requires the use of quality control specimens in each series of assays in order to check the performance of the assay. Controls should be treated as unknown samples, and the results analyzed with appropriate statistical methods.

## RESULTS

#### Calculation of results

Calculate the mean of the duplicate absorbance determinations. Construct a standard curve on log-linear graph paper by plotting the mean absorbencies of the six standards 0-5 (ordinate) against the corresponding osteocalcin concentrations (abscissa). Determine the osteocalcin concentration of the controls and each patient sample by interpolation.

Alternatively, a four-parametric logistic curve fit can be used.

#### Example

Standards/ Controls/ Specimen	Osteocalcin conc. (ng/mL)	A <sub>450-650</sub> (Abs)	Mean A <sub>450-650</sub> (Abs)	Interpolated Osteocalcin conc. (ng/mL)
Standard 0	0.0	1.997/1.991	1.994	
Standard 1	45.9	1.725/1.756	1.741	
Standard 2	169.9	1.063/1.030	1.147	
Standard 3	401.0	0.528/0.502	0.515	
Standard 4	801.0	0.329/0.320	0.325	
Standard 5	1510.0	0.191/0.178	0.185	
Control		1.322/1.243	1.262	118.5
Sample I		0.263/0.267	0.265	940.2
Sample II		0.869/0.922	0.896	211.6
Sample III		1.676/1.654	1.665	56.9

**Please note:** The data above are for illustration only and should not be used to calculate the results of any run.

#### Performance characteristics

*Cross reactivity towards rat osteocalcin:* **99±4% (mean±SD)**

Purified rat osteocalcin was diluted two-fold in Standard Buffer and measured in the Rat-MID™ Osteocalcin EIA. The observed concentrations spanned from 48.1 to 1660 ng/mL. The recoveries were calculated as (Observed conc./Expected conc.)\*100%.

**Detection limit:** **50.0 ng/mL**

This is the concentration corresponding to two standard deviations below the mean of 21 determinations of

#### **Osteocalcin**

#### **Standard 0**

#### **Imprecision**

The imprecision of the Rat-MID™ Osteocalcin EIA was evaluated for three serum samples. The imprecision result is based on 10 consecutive runs according to NCCLS EP5-A (11).

The results are summarized in the table below

	Interassay variation	Intraassay variation
Mean Osteocalcin (ng/mL)	CV (%)	CV (%)
948	7.7	3.4
215	5.5	5.0
152	6.6	3.6

#### **Linearity**

A rat serum sample was diluted with another rat serum (low concentration) and determined in the Rat-MID™ Osteocalcin EIA.

The result is summarized in the table below

Dilution procedure		Expected	Observed	Recovery %
High Serum 845 ng/mL (parts)	Low Serum 292 ng/mL (parts)	(ng/mL)	(ng/mL)	(ng/mL)
1	1	569	470	82.6
1	3	430	376	87.4
1	7	305	323	105.9
High Serum 593 ng/mL (parts)	Low Serum 292 ng/mL (parts)			
1	1	443	410	92.6
1	3	367	341	92.9
1	7	330	291	88.2

#### **Expected values**

It is advisable for a laboratory to establish its own range of expected values. As an example, the mean value, standard deviation and standard error of the mean for populations of 3 months-old SPRD female rats are given below.

Rat strain	Age (months)	Number of subjects	Mean values (ng/mL)	Standard Deviation (SD) (ng/mL)	Standard Error of the Mean (SEM) (ng/mL)
SPRD	3	30	417.8	83.5	15.3

## REFERENCES

1. Evaluation of Precision Performance of Clinical Chemistry Devices; Approved Guideline. *NCCLS EP5-A Vol. 19, No.2, February (1999)*.
2. Frolík CA. et al., Time-dependent changes in biochemical bone markers and serum cholesterol in ovariectomized rats: effects of raloxifene HCl, tamoxifen, estrogen, and alendronate. *Bone (1996);18;621-7*
3. Gallop PM. et al., Carboxylated calcium-binding proteins and vitamin K. *N Engl J Med (1980);302;1460-6*.
4. Gaumet N. et al., Influence of ovariectomy and estradiol treatment on calcium homeostasis during aging in rats. *Arch Physiol Biochem (1997);105;435-44*.
5. Hauschka PV. et al., Direct identification of the calcium-binding amino acid, gamma-carboxyglutamate, in mineralized tissue. *Proc Natl Acad Sci USA (1975);72;3925-9*.
6. Hauschka PV. et al., Osteocalcin and matrix Gla protein: vitamin K-dependent proteins in bone. *Physiol Rev (1989);69;990-1047*.
7. Kasugai Y. et al., Effects of tibolone (Org OD14) treatment for 3 months on ovariectomy-induced osteopenia in 8-month-old rats on a low-calcium diet: preventive testing for 3 months. *Bone (1998);22;119-24*. 8.
8. Lepola VT. et al., Bisphosphonates clodronate and etidronate in the prevention of ovariectomy-induced osteopenia in growing rats. *J Bone Miner Res (1996);11;1508-17*.
9. Poser JW. et al., Isolation and sequence of the vitamin K-dependent protein from human bone. Undercarboxylation of the first glutamic acid residue. *J Biol Chem (1980);255;8685-91*
10. Price PA. et al., Characterization of a gamma-carboxyglutamic acid-containing protein from bone. *Proc Natl Acad Sci USA (1976);73;1447-51*.
11. Rosenquist C. et al., Measurement of a more stable region of osteocalcin in serum by ELISA with two monoclonal antibodies. *Clin Chem (1995);41;1439-45*.
12. Seidlova-Wuttke D. et al., Pharmacology of Cimicifuga racemosa extract BNO 1055 in rats: bone, fat and uterus. *Maturitas (2003);44Suppl1:S39-S50*.



Use By



Batch code



Catalogue number



Manufacturer



Contains sufficient for &lt;n&gt; tests



Consult Instructions for Use



Temperature limitation



Immunodiagnostic Systems Limited,

10 Didcot Way, Boldon Business Park,

Boldon, Tyne &amp; Wear, NE35 9PD, UK

Tel.: +44 191 519 0660

Fax: +44 191 519 0760

e-mail: [info.uk@idsplc.com](mailto:info.uk@idsplc.com)• [www.idsplc.com](http://www.idsplc.com)