

*Measurement of
Creatine Kinase (CK)
&
Creatine Kinase-MB (CK-MB)*



Creatine Kinase (CK)

Action of CK:

- **CK** catalyses the conversion of **creatine** and consumes adenosine triphosphate (ATP) to create **phosphocreatine (PCr)** and adenosine diphosphate (ADP).



(in resting muscle)

(in performing muscle)



- This reaction take place in muscle so CK is important in synthesis of phosphocreatine as source of high energy.
- Creatine kinase (CK), also known as creatine phosphokinase (CPK) or phospho-creatine kinase.



Tissues sources

- Main source is skeletal muscle, cardiac muscle (heart) and brain.
- Low amounts in other tissues such as stomach, colon, kidney and intestine.
- Negligible amounts in liver & placenta.



Ck Iso-Enzymes

- Has different isoenzymes depending on location:
 - ↳ - **Cytosolic isoenzymes:**
 - Means that isoenzymes found in cytosol (cytoplasm of cell).
 - Characterized of CK is dimer (consisting of 2 polypeptide chains M (muscle) & B (brain) so give 3 iso enzymes.



A- CK-BB (ck 1):

- Found predominantly in brain and CNS (central nervous system).
- Small amounts in prostate, thyroid, gut and lung So found in little amounts in blood as it found in cerebrospinal fluid).

B- CK-MB (ck 2):

- Found in skeletal muscle by 2% & cardiac muscle by 2.5-3.5%, so specific for cardiac muscle (**heart**).
- Reference range of it represents by less than 1% of total CK.



C- CK-MM (ck 2):

- Found predominantly in skeletal muscle by 98% & cardiac muscle by 1-2%, so specific for skeletal muscle.
- Represents with high amounts due to muscle mass is high.

γ-Mitochondrial isoenzyme (CK-Mt):

- Fourth type of Ck-Isoenzymes found in mitochondria.
- Rarely seen in serum and when detected in serum it indicates tissues damage with release of mitochondrial contents.



- The major CK isoenzyme in the sera is CK-MM (94%) of the total CK activity.
- CK-MB is found in conc. Less than 1%.
- CK-BB is rarely detected.



Clinical significance

- Serum CK activity is elevated in tissue damages involving skeletal muscle, heart muscle and brain.

1- *Heart diseases:*

- CK₂ (CK-MB) activity in serum increases after myocardial infarction (MI). CK-₂ levels rise 2 to 6 hours after a heart attack.
- If there is no further damage to the heart muscle, the level peaks at 12 to 24 hours and returns to preinfarction level in 12 to 48 hours.



- CK-MB usually less than 1% of the total CK activity, but following an infarction values can increase up to 30% depending on the extent of myocardial damage.
- Ck-MB is more specific in MI diagnostic than CK total.



↳ *Skeletal muscle diseases:*

- High CK activity is found in all types of muscular dystrophy.



Reagents of CK

R¹ (buffer & coenzymes)	R² (enzymes):
Imidazol	ADP
Glucose	AMP
Acetyl cysteine	G ⁶ PDH
Mg-acetate	Creatine Phosphate
NADP	Hexokinase (HK).
EDTA.	



Principle of CK

- CK catalyzes the phosphorylation of ADP in the presence of creatine phosphate to form ATP and creatine.

Creatine Kinase



- The catalytic concentration is determined from the rate of NADPH formation measured at 340 nm .



Procedure

- 1 ml W.R + 0.1 μ serum.
- mix and incubate 3 min and read initial absorbance.
- start the stop watch and read after 1, 2, 3 min.
- calculate $\Delta A / \text{min}$.



Calculations

- $\Delta A / \text{min} \times 3333 = \text{----- U/L}$
- **Normal value:**
- Male: 36-174 U/L (due to have higher mass than female).
- Female: 26-140 U/L

