

# **$\beta$ -hCG**

Beta-human chorionic gonadotropin

Endocrine marker produced by the trophoblast soon after implantation.

Plays an important role in the initial stages of pregnancy (but appears to have little or no apparent function in mid to late pregnancy).

Its presence and rapid rise makes it an excellent marker for pregnancy.

$\beta$ - hCG can be detected in the blood stream. Is excreted by the kidney and detected in urine.

## **Quantitative and Qualitative**

### **Qualitative**

Basis of urine pregnancy tests

Presence or absence of hormone

Urine tests measure the urine  $\beta$ - hCG qualitatively, which means that the results are either "positive" or "negative."

Since  $\beta$ - hCG is not normally detected in the urine of a non-pregnant woman, its presence is enough to confirm a pregnancy.

Accurate after 10 days from conception.

All urine qualitative  $\beta$ - hCG tests should, if possible, be done on a first morning urine sample.

### **Quantitative**

Exact value

Basis of serum detection

Blood levels detected several days earlier than in the urine.

Serum  $\beta$ - hCG more sensitive than urine.

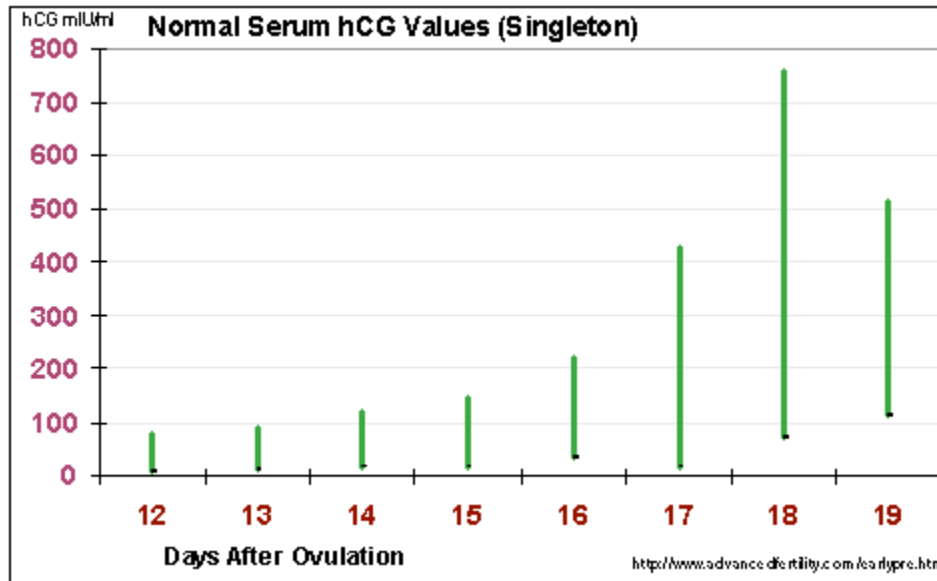
serum  $\beta$ - hCG can detect pregnancy several days earlier (as early as 10 days after fertilization, 3-4 days after implantation).

In a normal pregnancy this should double every 48-72 hours (i.e. exponentially)

After the first trimester, levels of  $\beta$ - hCG fall to much lower but still detectable levels<sup>1</sup>.

1 week after implantation 5-50mlu/ml

(End of 1<sup>st</sup> trimester 8 to 12 weeks) peak levels 100,000 -200,000



With most women levels return to a non-pregnant range about 4 - 6 weeks after a pregnancy loss has occurred. Depending on how the loss occurred, and how high levels were at the time of the loss.

The doubling of the  $\beta$ - hCG only applies to an early pregnancy, up to an hCG of about 6,000. After that, the hCG rises much slower, and at 10-11 weeks it normally drops.

### Serial measurements

A single hCG value doesn't give enough information about the viability of the pregnancy. Serial serum  $\beta$ - hCG levels are necessary to differentiate between normal and abnormal pregnancies and to monitor resolution of ectopic pregnancy once therapy has been initiated.

During 1<sup>st</sup> trimester it should double every 36-48 (48-72) hours of healthy pregnancy

In a nonviable pregnancy it also rises slower

In an ectopic it may climb at a lower rate or plateau.

The major disadvantage in relying on serial titers to distinguish between normal and abnormal pregnancies is the potential for delay in reaching the diagnosis. Furthermore,

while serial bhCG titers may be used to differentiate between a normal and an abnormal gestation, the test does little to indicate the location of the pregnancy. Hence, additional diagnostic modalities, including US and other biochemical markers, are needed.

### **Massive variability**

Measurement of HCG levels for pregnancy testing has several limitations, including substantial daily variation in HCG levels in individual women, difficulty in interpreting whether a single value is normal for gestational age, and the length of the biological half-life of intact HCG.

Normal hCG values vary up to 20 times between different pregnancies

[In early healthy intrauterine pregnancies, serum levels of bhCG double approximately every 2 days (1.4-2.1 d). Kadar et al (1994) established that the lower limit of the reference range to which serum bhCG should increase during a 2-day period is 66%. For example, a pregnant patient with a serum bhCG level of 100 mIU/mL should have a serum bhCG level of at least 166 mIU/mL 2 days later. An increase in bhCG of less than 66% is associated with an abnormal intrauterine pregnancy or an extrauterine pregnancy. ]

NB:

An increase of 60% in 48 hours is still considered normal

15% of healthy intrauterine pregnancies do not increase by 66%

13% of all ectopic pregnancies have normally rising bhCG levels of at least 66% in 2 days.

Shepherd et al (1990) demonstrated that 64% of very early ectopic pregnancies initially may have normal doubling bhCG levels.

Beware of interpretation of serum  $\beta$ -hCG

### **Accuracy**

An hCG of less than 5 mIU/cc is usually negative, over 25 mIU/cc usually positive, between 5 and 25 mIU/cc it's "equivocal"

Accuracy depends on

1. Timing of Implantation
2. Blood hCG level
3. Urine hCG level
4. Sensitivity of the pregnancy test

With most current pregnancy test kits (sensitivity 25 milli-international units per milliliter) hCG can be detected in the urine **as early as** 3-4 days after implantation (9-15 days after ovulation)

**Other causes of** positive pregnancy test

(Abnormal  $\beta$  hcg production)

- Miscarriage (early pregnancy loss, spontaneous abortion)
- For several weeks after a pregnancy.
- After certain [injections for ovulation induction](#)
- [Ectopic pregnancy](#)
- Hydatidiform mole
- Persistent molar disease or trophoblast disease
- Germ cell, bladder, and other non-trophoblastic malignancies
- testicular tumours in males

Different brands of [pregnancy tests](#) have different sensitivities and will first show a positive sign at different hCG levels.

- With most current pregnancy test kits (sensitivity 25 milli-international units per milliliter) hCG can be detected in the urine **as early as** 3-4 days after implantation (9-15 days after ovulation), though it sometimes can