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# Normal Hormone Proportions

## Introduction:

One would think that the general order of magnitude of the various hormone levels would have been made clear in medical, nursing or undergraduate school. Obviously, women make lots of estrogen and men make lots of testosterone, right? Women must certainly make much more estrogen than testosterone, right? We hardly hear about androstenedione and dehydroepiandrosterone so, probably, there isn't that much of them around. That certainly must be true. **WRONG!!**

**Women's blood contains ten times as much Testosterone as Estradiol most of the time.**

**In the luteal phase of the cycle, a woman has about one hundred times as much Progesterone as Estradiol.**

**Fifty-year-old men make about as much Estradiol as their wives.**

**Many men with erectile problems have too much estrogen, not too little Testosterone.**

**DHEA is the most common steroid hormone in the body and we don't fully know what its function is.**

Lets take a look at the proportions of the various hormones to get a better feel for what is going on. Interpretation of laboratory work and managing replacement and supplemental therapy require a basic understanding of what is circulating in the serum and how to affect available hormone levels.

## Unit Nomenclature:

Unit Name	Symbol	Order of magnitude	Proportion	Concentration in fluid
deci	d	$10^{-1}$	1/10	One part in ten
centi	c	$10^{-2}$	1/100	One part in a hundred
milli	m	$10^{-3}$	1/1,000	One part in a thousand
micro	mc	$10^{-6}$	1/1,000,000	One part in a million
nano	n	$10^{-9}$	1/1,000,000,000	One part in a billion
pico	p	$10^{-12}$	1/1,000,000,000,000	One part in a trillion

## **Estradiol:**

Estradiol is really powerful stuff, as you shall see. A normal young woman starts her menstrual cycle at about 20-40 pg/ml. Just before ovulation, common levels are 150-280 pg/ml in the serum. That is, she has 20-280 parts per **trillion** in her serum. A menopausal woman on HRT ranges from 20-100 pg/ml. A Vivelle Dot 0.0375 mg/day patch will achieve serum levels of about 25 pg/ml. The strongest patch, Vivelle Dot 0.1 mg/day will give levels around 80 pg/ml. For many menopausal women, that is too high.

## **Progesterone:**

Progesterone is much less powerful. A normal mid-luteal phase young woman has typical progesterone levels of 10-20 ng/ml. That is 10-20 parts per **billion** in her serum. Progesterone 100 mg pills, capsules or tablets given at bedtime will yield results on blood drawn the next day of about 1.5-8.0 ng/ml.

**One ng/ml = 1,000 pg/ml.**

So, a woman on HRT with typical values of:

Estradiol equal to 50 pg/ml

Progesterone equal to 5 ng/ml. Using the same units as Estradiol, Progesterone is 5,000 pg/ml

**She has 100 times as much Progesterone in her serum as she does Estradiol.** Now you know why there will never be a bioidentical progesterone patch. It would have to be way too big. There is much more progesterone in the blood than estradiol.

## **Testosterone:**

Typical Testosterone at any age is between 20-70 ng/dl. Pay attention here, the lab changed the serum quantity units. This is nanograms/**deciliter**. The nanograms are just like progesterone but the serum quantity has changed from amounts per milliliter to deciliter, which is one hundred times bigger.

There are 10 dl in a liter. There are 1,000 ml in a liter.

50 ng/dl is only 0.5 ng/ml

So, lets go back to our typical HRT woman.

She has: Estradiol equal to 50 pg/ml

Progesterone equal to 5 ng/ml

Testosterone equal to 50 ng/dl

That means she has: **One hundred times as much Progesterone as Estradiol**

**Ten times as much Testosterone as Estradiol.**

But I thought women mostly have estrogen while men have testosterone? Wrong! But remember:

**Estrogen is really powerful stuff!!**

## DHEA-S

DHEA and DHEA-S gradually decline with age. The “normal” values from the lab present such a huge range as to be useless. I usually get DHEA-S because it is virtually entirely adrenal in origin and I use it as a measure of adrenal output and health. There will be a separate paper on adrenal, but there are some things worth noting here. Healthy women in their 20s run around 200 mcg/dl. I find that PCOS patients run higher levels. This has been documented in other places, but I have never found a good explanation. Good levels for women around 50 years old run around 100 mcg/dl. Lets look at the units again.

One mcg or microgram is one part per million. To go back to the comparison with Estradiol:

One mcg =  $10^6$  or one million pg.

100 mcg/dl = 1 mcg/ml  
= 1,000,000 pg/ml

So, back to our typical menopausal patient with an HRT Estradiol of 50 pg/ml:

She has 20,000 times as much DHEA-S in her serum as Estradiol

**Cortisol, DHEA and DHEA-S are all in the same general range of concentration. They are 10,000 times as concentrated in the serum as Estradiol.**

## Summary:

Lets take one final look at that typical healthy HRT patient.

Hormone	Lab Value	Pico grams/ml	Relative Concentration
Estradiol	50 pg/ml	50 pg/ml	1:1
Testosterone	50 ng/dl	500 pg/ml	10:1
Progesterone	5 pg/ml	5,000 pg/ml	100:1
DHEA-S	100 mcg/dl	1,000,000 pg/ml	20,000:1
Total T-4	10 mcg/dl	100,000 pg/ml	2,000:1
Total T-3	100 ng/dl	1,000 pg/ml	20:1
Free T-4	1.2 ng/dl	12 pg/ml	1:4
Free T-3	300 pg/dl	3 pg/ml	1:16
50 year old male values			
Testosterone	500 ng/dl	Ten times that of a	50 year old woman
Estradiol	20-50 pg/ml	About the same as the	50 year old woman
18 year old male value			
Testosterone	1,200 ng/ml	Thirty times that of a	18 year old woman

By the way, after having looked at values for about two thousand patients, the values I have chosen are typical for women who are vibrant, healthy and active. **These are what I consider the real Normal values.**

Dropping male testosterone affects libido and erectile function, but so does rising estrogen. Abdominal fat converts Testosterone into Estradiol in both sexes. Giving extra Testosterone to obese men may only make matters worse.

It is amazing that laboratory science can directly measure Free T-3 at only **three parts per trillion** in serum. T-3 is extremely powerful stuff.