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# THE JOURNAL OF ENDURANCE

August 2004 #7

“Nolite id cogere, cape malleum majorem!”

“Don't force it, just get a bigger hammer!”

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Greetings, the following questions are reviewed in this issue:

**#1 What supplements reduce Aromatase (cause of excess estrogen) in masters-age male and female athletes?**

**#2 What influences testosterone levels?**

**#3 How does stress inhibit performance and what is the hormonal resolution?**

**#4 What hormone influences regeneration of Cytochrome c Oxidase?**

**#5 What natural food influences regeneration of Cytochrome c Oxidase as a longevity-enhancing and cancer-inhibiting substance with performance-enhancing implications?**

**#6 Does hydration increase weight loss or reduce the rate of weight gain?**

**#7 When and what motivates endurance athletes to exchange of information ontraining, diet, nutritional supplements and energy fuel sources?**

**#8 What resolves Vitamin B-12 & Folate deficiency influencing both health and performance?**

**#9 What is increases thirst (besides dehydration) during a hot endurance event?**

**#10 Does male testosterone decrease with age or overtraining, and if so, how much?**

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**#1 What supplements reduce Aromatase (cause of excess estrogen) in masters-age male and female athletes?**

**Chrysin: Is It An Effective Aromatase Inhibitor?**

**Dr. Ward Dean M.D. (1)**

Estrogen (estradiol) is metabolized by the body by way of 2 pathways. One pathway, 16-alpha-hydroxylation, is known as a "tumor-enhancing" metabolic pathway. This is the predominate pathway in patients with breast or endometrial cancer, and in those at

increased risk for such cancers. 16-alpha-hydroxylation activity precedes clinical evidence of cancer, and is a significant risk factor for estrogen-dependent tumors (2). 16-alpha hydroxylation is nearly 500% higher in patients with breast cancer than patients who don't have cancer (3). The other pathway is called the "tumor suppressor" pathway. Estrogen is transformed into 2-hydroxyestrone (20HEI), which is an antiestrogen. When estrogen traverses through the 2-hydroxylation pathway, the incidence of cancer decreases. Healthy individuals not at risk for breast or endometrial cancer bypass the 16-alpha route and metabolize estrogen through the 2-hydroxyestrone pathway.

Scientists found that a substance found in cruciferous vegetables, Indole-3-Carbinol (I3C), causes the body to metabolize estrogen AWAY from the "tumor-enhancing" 16-alpha-hydroxylation pathway to the harmless "tumor-suppressing" 2-hydroxylation path. By funneling estrogen into a "tumor-suppression" inactive, I3C stimulates the rate at which the body expels estrogen, away from producing excessive estrogen levels. Scientists found that only 400 mg Indole-3-Carbinol given daily resulted in a +50% increase of 2-hydroxylation (4, 5). Indole-3-Carbinol appears to be an effective weapon against breast, cervical cancer, skin cancer, respiratory papillomas, and other harmful estrogen-excess disorders. Another alternative to I3C, with similar effects, is a metabolite of I3C, Diindolymethane.

**There is no effective natural inhibitor of aromatase.** (Those who require the specific benefits of aromatase inhibition must rely on the safe expensive prescription aromatase inhibitors.) **However...some beneficial aromatase inhibition may be achieved by enhancing metabolism and excretion of excess estrogens by oral dose of either Indol-3-Carbinol or Diindolymethane.**

## References

- (1) By permission, courtesy of Robert Watson, President, Vitamin Research Corporation. VRP manufactures both dietary supplements Indole-3-Carbinol & Diindolymethane dietary supplements (800-877-2447). Excerpts quoted from Dr. Ward Dean M.D., article @: Dean W. *Chrysin: Is It An Effective Aromatase Inhibitor?*  
<http://www.vrp.com/art/1208.asp?c=1088084063018&e=chrysin&f=CHRY SIN&g=chrysin&k=/go/ libs.asp&m=/includes/vrpwebstyle.css&s=0>
- (2) J Steroid Biochem. 1984; 20(4B): 1077-1081.
- (3) J National Cancer Inst. 1993; 85(23): 1917-1920.
- (4) J Natl Cancer Inst, 1990; 82(11): 947-949.
- (5) Nutr Cancer, 1991;16 (1): 59-66.

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## #2 What influences testosterone levels?

**ENDOGENOUS NATURAL PATHWAY:** Luteinizing Hormone (LH) stimulates the production of Testosterone by the Leydig Cells of the Testicles.

MALE average      Testosterone is only 7.0 mg daily.  
FEMALE average    Testosterone is only 0.3 mg daily.

**MALES** get their higher Testosterone from testes, yet equal amounts are manufactured by the adrenal glands in both males and females.

**FEMALES:** Small significant amounts of Testosterone are manufactured by the female Ovaries until Menopause. Ovary-manufactured Testosterone contributes to female Sexual Desire. After menopause approximately 35% of females have reduced sexual desire due to the cessation of testosterone production by the ovaries (the other 65% manufacture enough testosterone in their adrenal glands to sustain their sexual desire).

### **CIRCADIAN CYCLIC RHYTHM INFLUENCES TESTOSTERONE LEVELS**

Testosterone production also has a monthly cycle but there is no clear evidence regarding the time of the month for peaks and troughs.

Peak Testosterone levels occur between 6-8 a.m. with absolute peak around 8:00AM. Lowest levels occur from 6-10 PM with absolute lowest levels at 8:00 PM. The differences between peak and trough production of Testosterone are large (up to 1/3 of total serum Testosterone). Testosterone is not produced within the body in a totally continuous fashion, hence production may vary subject to a circadian rhythm:

**MEN** in the Northern Hemisphere, the lowest levels of Testosterone occur in January to April/the highest levels of Testosterone occur in July to October (peaking from 8 September to 23 October)

**MEN** in the Southern Hemisphere, lowest Testosterone levels would occur in July to October/ highest Testosterone levels would occur in January to April.

**WOMEN** (I speculate have similar responses though no research confirms)

**TESTOSTERONE LABORATORY REFERENCE VALUES (Males: Free Testosterone)**  
The following free Testosterone levels are regarded as normal for males aged 20-49 (values differ between different laboratories). We use free salivary specimen sample by ZRT Labs and recommend 90-100% or more of max normal range 180-200 pg/ml free testosterone for a competitive athlete during training prior to competition.

<b>LAB ESTABLISHED STANDARD</b>	<b>NORMAL REF RANGE</b>	<b>OPTIMAL RANGE</b>
Lab Corp	12.4-40.0 pg/mL	26-40 pg/mL
Smith Kline	34-194 pg/mL	128-194 pg/mL
Quest Labs	50-210 pg/mL	138-210 pg/mL
<b>ZRT LABORATORY</b>	50-200 pg/ml	131-200 pg/ml

From a small sample taken from athletes during training, the ranges were between 42-63% of the max normal reference range or 27-47%; this is too low for optimal (90% or above desired) anabolic strength gain during training.

## DIET EFFECTS TESTOSTERONE LEVELS

↑ ⇒ increase

↓ ⇒ decrease

[1] **HIGH INTAKE OF PROTEIN** increases levels of (free, unbound) Testosterone versus **LOW INTAKE OF DIETARY PROTEINS** decreases Testosterone by increasing levels of Sex Hormone Binding Globulin (SHBG) which binds to Testosterone causing it to be unavailable to its receptors; conversely high intake of Dietary Proteins lowers SHBG levels which causes more free, unbound Testosterone to become available for binding to Testosterone's receptors. Normally, 1%-3% of endogenous Testosterone is in its free, unbound state, while 44% is bound to Sex Hormone Binding Globulin (SHBG) and 54% is bound to Albumin and other endogenous Proteins (Testosterone that is Albumin-bound IS AVAILABLE for tissue uptake; approximately 56% of the body's Testosterone is readily available for uptake into tissues.) **LOW PROTEIN DIET DOES NOT SUPPORT ANABOLIC PRODUCTION OF TESTOSTERONE.**

[2] **REDUCED DIETARY FAT** intake from **40%** to **↓ 25%** (dietary fats as a % of total diet) resulted in an average **-15%** **↓ decrease in "Free" testosterone.** Researchers determined that dietary Fats should comprise 25%-30% of total calorie intake in order to maintain optimal Testosterone production. **LOW FAT DIET DOES NOT SUPPORT ANABOLIC PRODUCTION OF TESTOSTERONE.**

[3] **SATURATED FATS** **↑ increase endogenous Testosterone levels.** Supplemental Superunsaturated Fatty Acids (SUFAs) stimulate the Leydig Cells of the Testicles to synthesize Testosterone.

[4] **ISOFLAVONES** such as **DAIDZEIN** (extract soybeans) **increase** serum testosterone (and beta-endorphin) in castrated rats. The same results were obtained in chickens given total SOY ISOFLAVONES. **VELVET BEANS** are reported to increase Testosterone.

[5] **OATS** are claimed to stimulate the release of Testosterone from its "bound" state (with Sex Hormone Binding Globulin (SHBG)) to its "Free" state.

[6] **GARLIC** increases Testosterone levels (due to the Diallyl Disulfide content of Garlic increasing Luteinizing Hormone (LH) levels.

## SUPPLEMENTS EFFECT TESTOSTERONE LEVELS

[1] **ACETYL-L-CARNITINE (ALC)** increases plasma Testosterone levels (via its influence on Acetylcholine neurotransmission in the Striatum Cortex of the Brain).

[2] **MELATONIN** prevents the age-related decline in Testosterone production. A 1995 study demonstrated that nightly supplementation of melatonin to rats prevented age-

related decline in testosterone production. Melatonin supplemented rats had nearly 300% the level of testosterone compared with rats that didn't receive melatonin. Conversely, one study has demonstrated that supplemental HIGH DOSE====>MELATONIN INHIBITS the production of Testosterone - However, LOW DOSAGE LEVELS OF MELATONIN (up to 3 mg per day) do not appear to interfere with Testosterone production. Males produce Testosterone over a 24 hour cycle - the highest levels occur in the morning. Testosterone production and release does also occur qualitatively DURING SLEEP meaning sleep deprivation leads to lower serum levels of Testosterone.

[3] **BETA-SITOSTEROL** inhibit the conversion of Testosterone to Dihydrotestosterone and Estradiol (by inhibiting the 5-Alpha Reductase and Aromatase enzymes)

[4] **BORON** increases serum Testosterone levels - Boron does not raise Testosterone to higher than normal physiological values but does appear to restore Testosterone levels in older males to levels that they had in their 20's and 30's.

[5] **POTASSIUM** helps to **REGULATE** plasma Testosterone levels (Potassium deficiency can lead to sub-optimal plasma Testosterone levels. Potassium is high in whole plant foods such as fruits and vegetables.

[6] **ZINC & SELENIUM** are essential cofactors for the endogenous production of Testosterone and supplemental Zinc increases Testosterone levels related to mineral deficiency. Zinc also inhibits the conversion of Testosterone to Dihydrotestosterone (by inhibiting the 5-Alpha Reductase enzyme that catalyzes this conversion). Low Testosterone levels (in males) may occur as a result of Zinc or Selenium deficiency.

[7] **VITAMIN A** helps to regulate plasma Testosterone levels (Vitamin A deficiency can lead to sub-optimal plasma Testosterone levels).

[8] **FENUGREEK SEEDS** may increase Testosterone levels (Steroid Saponins in Fenugreek Seeds stimulate the release of Luteinizing Hormone which in turn stimulates the production of Testosterone).

[9] **KOREAN GINSENG** increases the body's endogenous production of Testosterone.

[10] **HORNY GOAT WEED & MACA** are claimed to increase Testosterone levels.

[11] **NETTLE EXTRACT** inhibits the binding of Testosterone to Sex Hormone Binding Globulin (SHBG), resulting in lower levels of "bound" Testosterone and higher levels of "free" Testosterone (this occurs from Nettle binding to SHBG in place of Testosterone).

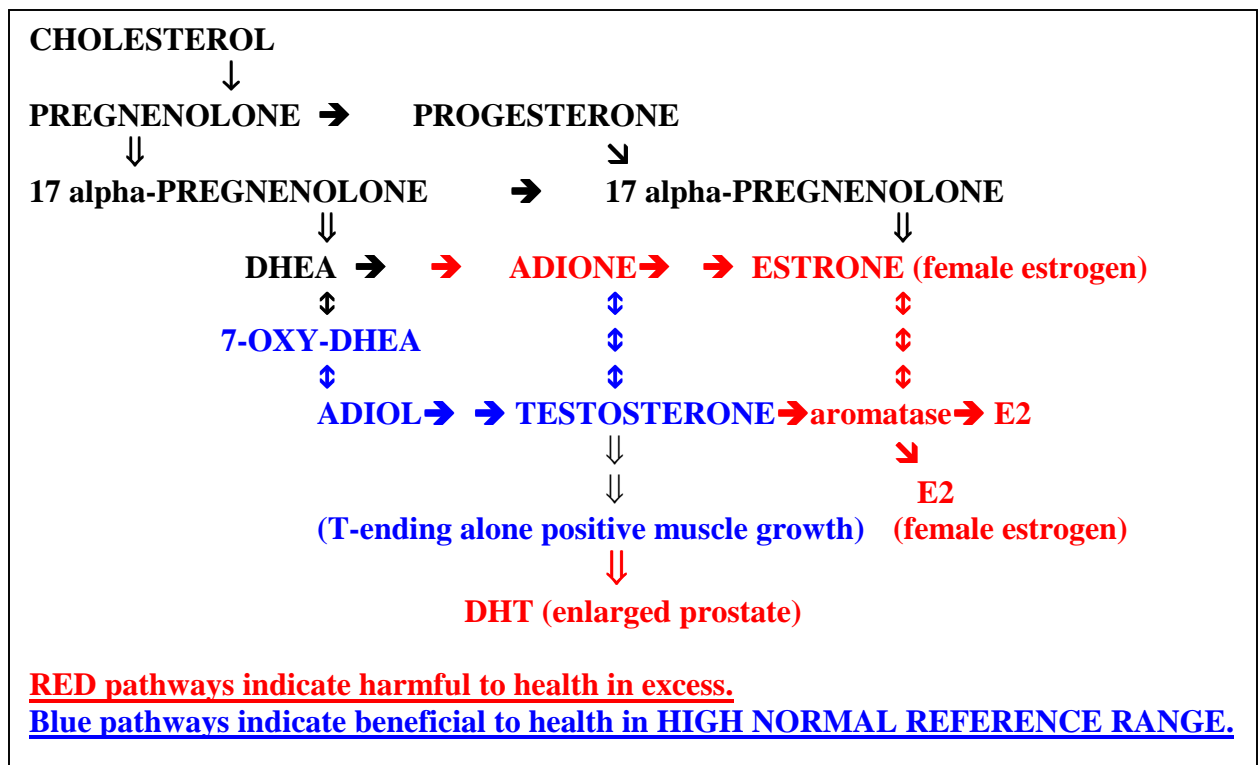
[12] **SAW PALMETTO** inhibits the conversion of Testosterone to Dihydrotestosterone (DHT).

[13] **TRIBULUS TERRESTRIS** is claimed to increase production of Luteinizing Hormone, which causes the testes to release more Testosterone. Tribulus terrestris is speculated to

enhance the conversion of Androstenedione to Testosterone (although Androstenedione is the immediate precursor of Testosterone, it is speculated that this conversion occurs under the influence of Luteinizing Hormone. Research suggests that daily intake of 750 mg of Tribulus terrestris results in an increase in free Testosterone levels of 30% (only in males) within five days.

[14] ROYAL JELLY is reported to contain Testosterone.

**COMMENT:** Testosterone appears to be a safe hormone ipotentiated to between 90-100% normal free testosterone reference range, especially during strength training bricks. DIET should be high protein, say 1.4-1.7 grams protein per kilogram body weight and at least 25-30% fat including meat-sources saturated fat, which supports the body's natural production of testosterone. Without such a caloric admixture, the body will not have the building blocks with which to manufacture testosterone. This means that during low fat, low protein, vegetarian diet intake, the testosterone levels will be predictably lower than with the opposite type of diet. Oats, Velvet Beans, Soy Isoflavones or Soy Protein Isolates and Garlic should be a staple of the vegetarian diet if testosterone levels are to be supported. Of the SUPPLEMENTS that may increase testosterone, Saw Palmetto, Nettle Extract, Tribulus Terrestris, Fenugreek Seeds, modest not high dose Melatonin, and Acetyl-L-Carnitine are recommended. Of the minerals that deficiency may reduce testosterone levels, there is no need to increase dose above sufficiency dose. Premium Insurance Caps provides each of the minerals at max dose in each 14-capsule packet. I do not recommend stimulating free Testosterone levels above 210 pg/ml or above 5% of normal maximum reference range.



By disclosure, excerpts of this information have been copied by permission from In-Tele-Health © 2002 (from Hyperhealth Pro CD-ROM) for educational purposes only. Any and all exogenous hormonal interventions should be regularly monitored by the athlete's healthcare physician.

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### **#3 How does stress inhibit performance and what is the hormonal resolution?**

Carl Lewis once said he would make every attempt to relax just enough to **“LET THE SPEED COME OUT.”** Stress before or self-imposed stress during an event inhibits performance. Extreme Adrenal stress depletes B vitamins and leads to increased amino acids demands as proteins breakdown. As output of cortisol increases with stress, omega-6 polyunsaturated fatty acids deplete. Vitamin C deficiency causes an elevation in cortisol. DHEA is the most abundant steroid hormone produced by the adrenals. DHEA circulates in the blood stream and is converted to TESTOSTERONE or estrogen as needed. Cortisol:DHEA ratio changes when one is high the other is low and they each change throughout the day but decrease with age or imposed stress.

Cortisol regulates glucose metabolism. In times of stress, cortisol rises accelerating the breakdown of proteins to produce fuel to maintain body functions. This activity must be balanced with periods of protein rebuilding in order to sustain health.

Cortisol levels normally vary according to circadian rhythms, and are linked to the sleep-wake cycle. Typically there is a significant Cortisol elevation in the morning and a gradual taper down till midnight when it is at its lowest. People with adrenal insufficiency show the greatest depression of cortisol output in the morning. In a healthy persons, cortisol levels are highest on waking and fall throughout the day to allow for restful sleep. The adrenal glands produce the stress hormones CORTISOL and DHEA. Cortisol is responsible for the many vital functions that allow us to interact and react to life threatening situations. One of the best times to test cortisol levels is first thing in the morning on an empty stomach. This reference value or proper range for cortisol first thing in the morning should be between 4 mcg/dl and 19 mcg/dl with the sample being taken from blood. The normal range for free cortisol levels measured from urine is between 10 pg/ml and 110 pg/ml. Cortisol has other hormone-modifying effects. Cortisol can directly inhibit pituitary gonadotropin and TSH (thyroid stimulating hormone). If TSH is modestly high normal, it may indicate mild Hypothyroid. Cortisol excess may lead to a progressive loss of protein, muscle weakness and atrophy, and loss of bone mass through increased calcium excretion and less calcium absorption. That is one of the reasons long-distance runners tend to have skinny physiques. With the amount of stress that runners place on their bodies, they have high levels of free radicals as well as cortisol. Excess cortisol can also adversely affect tendon health. Cortisol causes a redistribution of body fat to occur through an unknown mechanism. Basically, the extremities lose fat and muscle while the trunk and face become fatter. Some of the signs of overtraining include higher cortisol levels, which may cause depression-type effects. Cortisol excess can also lead to hypertension because it causes sodium retention (which can make you appear bloated) and potassium excretion. In other words, excessively high

cortisol levels may induce female characteristics. DHEA:Cortisol balance ratio is one goal which your doctor may want to consider along with low thyroid production as seen with high TSH, though that may come around if DHEA:Cortisol ratio returns to normal.

When cortisol is high then DHEA is generally low. DHEA acts as a stress reservoir as well as a hormonal intermediary. It is converted to other hormones such as testosterone and estrogen. DHEA acts as a stress reservoir as well as a hormonal intermediary. DHEA is converted to other hormones such as testosterone and estrogen. DHEA also has direct effects on metabolism and immunity. Disease, emotional stress and physical stress such as over training can cause imbalances in these vital adrenal hormones.

Simultaneous hypothyroid, hypoDHEA, with hyper-testosterone & hyper-cortisol. Cortisol inhibits growth-hormone levels by stimulating the release of somatostatin (a growth-hormone antagonist). It may also reduce IGF-1 expression (IGF-1 is one of the most anabolic agents in the body and is the substance that is responsible for most of growth hormone's positive effects because GH converts into IGF-1 in the liver). Elevated cortisol levels need to be corrected and a balanced respectively as normal reference range Cortisol:DHEA levels.

## RESOLUTIONS ADRENAL STRESS PROTOCOLS

### SUPPLEMENTS REDUCE ↓ CORTISOL OR IMPROVE ↑ DHEA: ↓ CORTISOL RATIO

Coenzyme Q-10, Phosphatidylserine, Acetyl-L-carnitine, Gingko Biloba, Garlic, L-Tyrosine, Vitamin B-Complex (especially B-5), Vitamin C + bioflavonoids relieve adrenal stress factors and assists adrenal function essential for proper adrenal function. Supplemental Zinc as Zinc Monomethionone Aspartate increases testosterone production.

### CALORIC ADEQUACY

Restricting calories and overuse/overreaching/overtraining all may contribute to excess cortisol and decreased DHEA leading to adrenal stress syndrome.

### INSULIN SPIKE TIMING

Insulin actually interferes with cortisol and may enhance cortisol clearance from the body. Spiking insulin levels after a workout (by consuming a high-glycemic index carbohydrate) may help minimize excessive cortisol levels since cortisol levels are elevated significantly post-resistance training.

### STRESS MANAGEMENT INTERVENTIONS

(Examples are: acknowledgment, prayer, counseling, medical Rx., diet, supplements, & exercise.)

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### #4 What hormone influences regeneration of Cytochrome c Oxidase?

The influence of thyroid hormone (T3) on respiration is partly mediated via its effect on the cytochrome c oxidase (COX) enzyme, a multi-subunit complex within the mitochondrial

respiratory chain. Researchers compared the expression of COX subunits I, III, Vb, and VIc and thyroid receptors (TR)1 and TR1 with functional changes in COX activity in tissues that possess high oxidative capacities. In response to 5 days of T3 treatment, TR1 increased 1.6-fold in liver, whereas TR1 remained unchanged. T3 also induced concomitant increases in the protein and mRNA expression of nuclear-encoded subunit COX Vb in liver, matched by a 1.3-fold increase in binding to a putative thyroid response element (TRE) within the COX Vb promoter in liver, suggesting transcriptional regulation. In contrast, T3 had no effect on COX Vb expression in heart. T3 produced a significant increase in COX III mRNA in liver but decreased COX III mRNA in heart. These changes were matched by parallel alterations in mitochondrial transcription factor A expression in both tissues. In contrast, COX I protein increased in both liver and heart 1.7- and 1.5-fold ( $P < 0.05$ ), respectively. These changes in COX I closely paralleled the T3-induced increases in COX activity observed in both of these tissues. In liver, T3 induced a coordinated increase in the expression of the nuclear (COX Vb) and mitochondrial (COX I) genomes at the protein level. However, in heart, the main effect of T3 was restricted to the expression of mitochondrial DNA subunits. Thus our data suggest that T3 regulates the expression of COX subunits by both transcriptional and posttranscriptional mechanisms. The nature of this regulation differs between tissues possessing high mitochondrial content, like liver and heart [1].

**COMMENT:** If your morning body temperature is subnormal your mitochondria energy production capacity may also be subnormal in terms of its regeneration rate of this energy-demand enzyme. Cytochrome c Oxidase is a mitochondria enzyme that influences the rate of energy production during aerobic exercise. Before anyone accuses me of advocating massive prohormone interventions such as those observed in the body-building world, I state that I advise high normal reference range balance between metabolic and anabolic hormone levels. If thyroid is low or sluggish, a low morning body temperature may occur. As such, low normal reference range thyroid may not show on the TSH scale commonly used by doctors to justify prescribing thyroid hormone meds.

Alternative medicine M.D.'s typically utilize the following standard:

1. Basal Metabolic Rate - Waking AM body Temperature should be between 97.8 and 98.2; if less on a regular basis, Armour Thyroid at a dose that raises temp and does not cause the "jitters" is a possible first step-resolution to reversing excess mid-body fat storage
2. TSH & T-3 Thyroid Tests may or may not indicate depressed metabolic rate hormone
3. DHEA & Cortisol levels measures throughout the day
4. Estrogen/Testosterone Measures

IF any one of these markers is excessive or imbalanced with the others, thyroid deficiency may be the culprit. As with any hormone replacement protocol, the results should not elevate hormones outside normal reference range nor should unwanted side effects be

tolerated. Therefore, parallel alterations in mitochondrial transcription factor A expression in both tissues is desirable assuming high normal reference thyroid production is activated. The high normal reference hormone levels in youth may induce positive health enhancing and performance-indicating effects.

#### Reference

[1] Tissue-specific regulation of cytochrome c oxidase subunit expression by thyroid hormone Treacey E. Sheehan, Ponni A. Kumar, and David A. Hood *Am J Physiol Endocrinol Metab* 2004;286 968-974.

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#### **#5 What natural fruit influences regeneration of Cytochrome c Oxidase as a longevity-enhancing and cancer-inhibiting substance with performance-enhancing implications?**

Epidemiological studies have noted a consistent association between the consumption of diets rich in fruits and vegetables and a lower risk for chronic diseases including cancer and cardiovascular disease. There is accumulating evidence that much of the health-promoting potential of these plant foods may come from phytochemicals, bioactive compounds not designated as traditional nutrients. In **STRAWBERRIES**, the most abundant of these are ellagic acid, and certain flavonoids: anthocyanin, catechin, quercetin and kaempferol. These compounds in strawberries have potent antioxidant power. Antioxidants help lower risk of cardiovascular events by inhibition of LDL-cholesterol oxidation, promotion of plaque stability, improved vascular endothelial function, and decreased tendency for thrombosis. Furthermore, strawberry extracts have been shown to inhibit COX enzymes in vitro, which would modulate the inflammatory process. Individual compounds in strawberries have demonstrated anticancer activity in several different experimental systems, blocking initiation of carcinogenesis, and suppressing progression and proliferation of tumors. Preliminary animal studies have indicated that diets rich in strawberries may also have the potential to provide benefits to the aging brain (1).

#### Reference

(1) [Potential impact of strawberries on human health: a review of the science](#). Hannum, S. M., *Critical Reviews in Food Science and Nutrition* 2004;44(1):1-17.

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#### **#6 Does hydration increase weight loss or reduce the rate of weight gain?**

Drinking lots of water is commonly espoused in weight loss regimens and is regarded as healthy; however, few systematic studies address this notion. In 14 healthy, normal-weight subjects (seven men and seven women), researchers (1) assessed the effect of drinking 500 ml (approximately 16 fluid ounces) of water on energy expenditure and substrate oxidation rates by using whole-room indirect calorimetry. The effect of water drinking on adipose tissue metabolism was assessed with the microdialysis technique. Drinking 500 ml of water increased metabolic rate by +30%! The increase occurred within 10 min and reached a maximum after 30–40 min. The total thermogenic response was about 100 kJ. About 40% of the thermogenic effect originated from warming the water from 22 to 37 C (72 to 98.6

F.). IN MEN, lipids mainly fueled the increase in metabolic rate. In contrast, IN WOMEN carbohydrates were mainly used as the energy source. The increase in energy expenditure with water was diminished with systemic  $\beta$ -adrenoreceptor blockade. Thus, drinking 2 liters (approximately 72 fluid ounces) of water per day would augment energy expenditure by approximately 400 kJ (approximately -96 calories). Therefore, the thermogenic effect of water should be considered when estimating energy expenditure, particularly during weight loss programs.

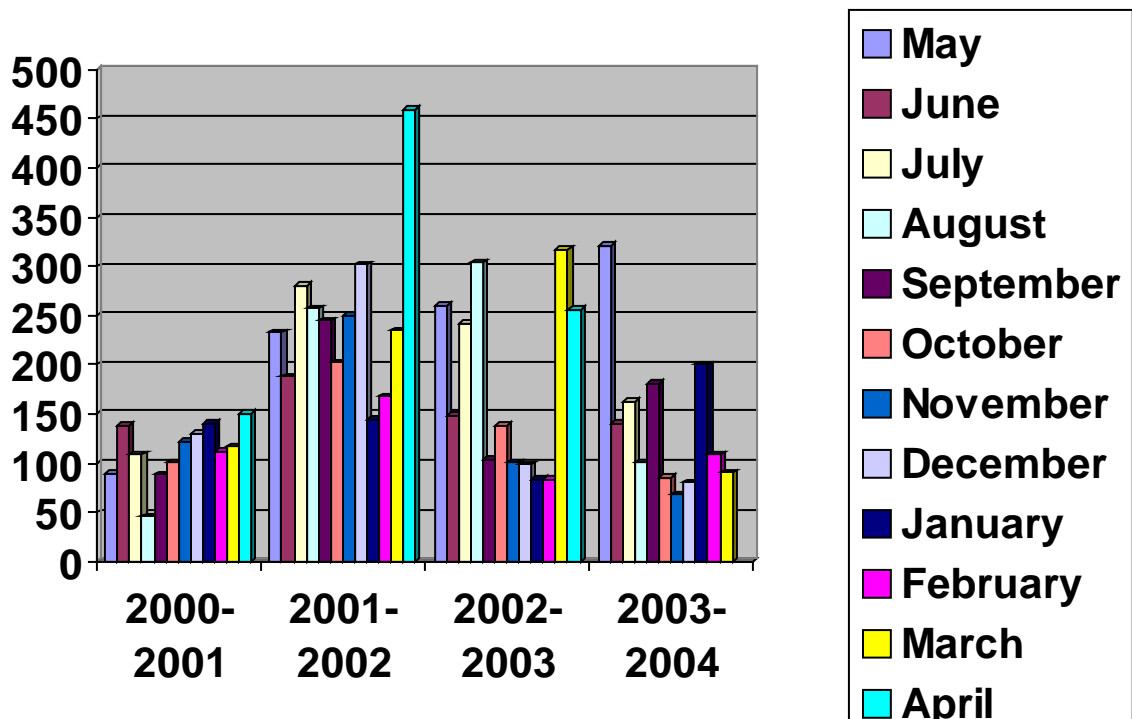
#### Reference

(1) Water-induced thermogenesis. Boschmann, M., Steiniger, J., Hille, U., Tank, J., Adams, F., Sharma, A. M., Klaus, S., Luft, F. C., Jordan, J., *The Journal of Clinical Endocrinology & Metabolism* 88(12):6015-6019.

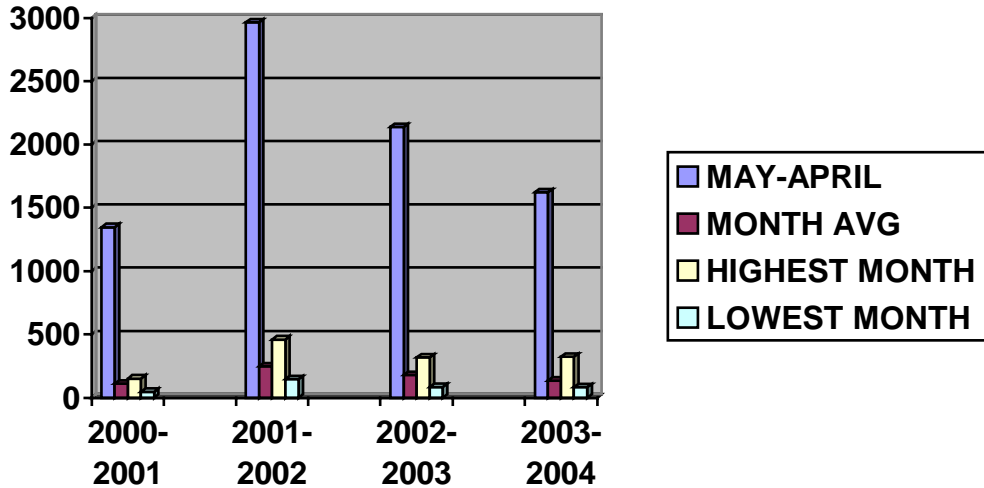
#### #7 When and what motivates endurance athletes to exchange of information on training, diet, nutritional supplements and energy fuel sources?

The Yahoo “*EnduranceList*” was organized January 2000 for endurance athletes to discuss all facets of training, diet, nutritional supplements and fuel sources. Between May of 2000 to April of 2004, endurance athletes posted 8074 comments, questions, or replies on the subject of health, nutrition, or sport-specific performance-related issues to this list. The responses generated between 2000-2004 reflect a pattern that appears to revolve around need-to-know, pre-season preparation, participation, thread interest generated, and time available pre-, during-, or post- season for reviewing list-generated replies.

TOTAL RESPONSES BY MONTH & YEAR (MAY-APRIL)

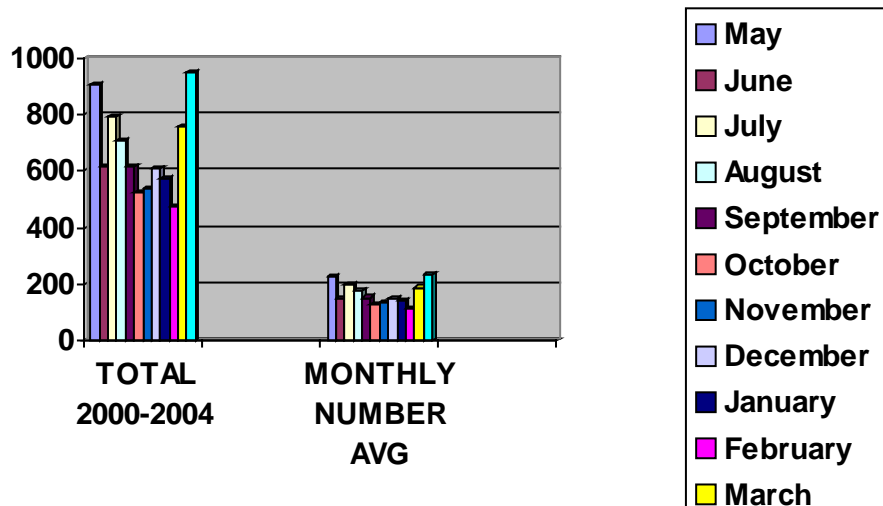


**TOTAL NUMBER OF RESPONSES BY YEAR MONTHLY AVERAGE HIGHEST MONTH LOWEST MONTH**



**SUMMARY REVIEW**

**TOTALS COMPARED - AVERAGE RESPONSES BY MONTH**



**CONCLUSION**

Necessity is the mother of invention, the driving force behind interest and research sparking exchange of information. Trend responses peaked between May 2001 and April 2002. While the number of responses posted has decreased since April 2002, the lowest number of replies each year occurs in October and November at the end of the competitive season, due to northern hemisphere climate change, while the highest number of responses occur during the months between April and May, or at the start of the competitive seasons.

While the number of responses posted has been decreasing since April 2002, the highest number of monthly replies has since stabilized between May 2002 & April 2004.

The 4-YEAR PATTERN RESPONSE FROM ENDURANCE ATHLETE LIST monthly replies between May of 2002 until April of 2004.

@: <http://health.groups.yahoo.com/group/endurancelist/>

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2004	<a href="#">200</a>	<a href="#">109</a>	<a href="#">91</a>	<a href="#">81</a>								
2003	<a href="#">84</a>	<a href="#">84</a>	<a href="#">317</a>	<a href="#">256</a>	<a href="#">321</a>	<a href="#">140</a>	<a href="#">163</a>	<a href="#">101</a>	<a href="#">181</a>	<a href="#">86</a>	<a href="#">68</a>	<a href="#">81</a>
2002	<a href="#">145</a>	<a href="#">168</a>	<a href="#">235</a>	<a href="#">459</a>	<a href="#">260</a>	<a href="#">149</a>	<a href="#">242</a>	<a href="#">304</a>	<a href="#">104</a>	<a href="#">138</a>	<a href="#">101</a>	<a href="#">99</a>
2001	<a href="#">141</a>	<a href="#">112</a>	<a href="#">117</a>	<a href="#">151</a>	<a href="#">233</a>	<a href="#">188</a>	<a href="#">281</a>	<a href="#">257</a>	<a href="#">245</a>	<a href="#">202</a>	<a href="#">250</a>	<a href="#">302</a>
2000					<a href="#">90</a>	<a href="#">138</a>	<a href="#">109</a>	<a href="#">46</a>	<a href="#">89</a>	<a href="#">101</a>	<a href="#">122</a>	<a href="#">130</a>

### #8 What resolves Vitamin B-12 & Folate deficiency influencing both health and performance?

#### VITAMIN B-12 & FOLATE DEFICIENCY ASSOCIATED WITH LOW HCL PRODUCTION

Gastric acid secretion from the parietal cells in the normal healthy stomach is 10% without the stimulus of food presence resulting a low acidic pH of between 1.8-2.0. At 1.8 pH, the gastric hydrochloric acid (HCL) produced in the stomach is turned off. When masticated foods fill the stomach, gastric HCL is turned on in order to reduce food-elevated pH from as high as 4.5 back to the empty stomach 1.8 value. The healthy-normal acid is a preventative barrier to reduce food/water borne microorganism infection. Besides aiding protein digestion, a high-normal acidic pH is required to produce the "Intrinsic Factor", which is responsible for 98% of the absorption of Vitamin B-12. Approximately 1-2% of the Vitamin B-12 absorbed from food or supplements occurs without the assistance of the "Intrinsic Factor" (IF). This means the in order to gain a minimal life-sustaining 10-20 micrograms per day, you would need to consume 1000 micrograms B-12 each day if your body was unable to produce IF.

#### NORMAL-HEALTHY GASTRIC HCL ABSORPTION OF B-12 (FOLATE AID)

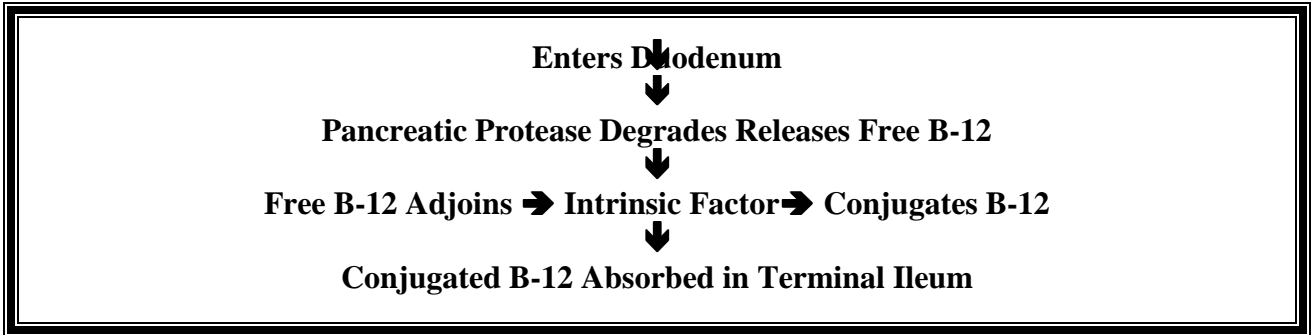
Vitamin B-12 Food or Supplement + Intrinsic Factor Produced



Pepsin Food Protein Complex



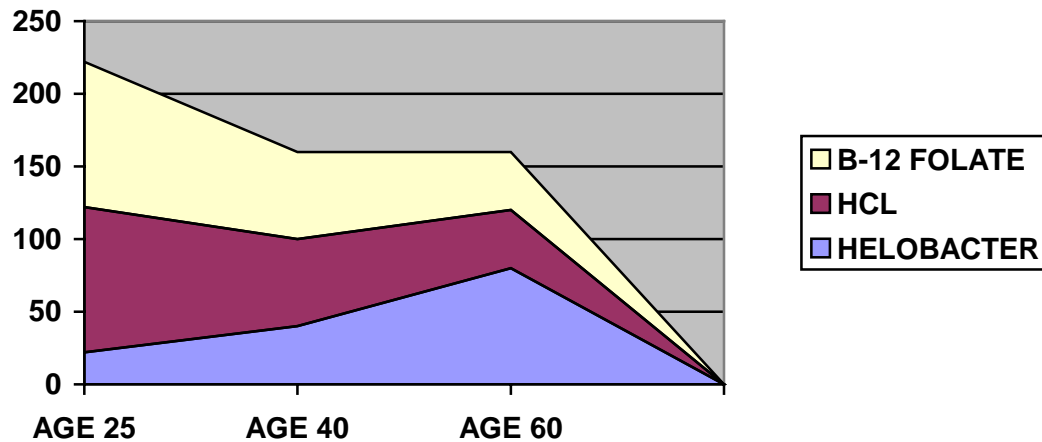
Binds R-Protein (glycoprotein)



Recently, Plummer (2004) reported a surprising epidemic prevalence of disorders associated with unhealthy less-than-normal gastric acid production due to:

(a) Atrophic Gastritis

(b) Helobacter Pylori



The sum of this evidence suggests that atrophic gastritis is greater than 15% in all adults above age 25, but more than 30% in adults above age 60. Good evidence is presented from 5 countries (Taylor & Blaser 1991) that Helobacter Pylori infects 1% of the body's capacity for HCL production for each year of age! I estimate that combined likelihood of having a healthy normal rate of gastric acid production is reduced by each year of life by 1.3% per year of life. If you are 40 years old or roughly 1 out of 2 of all 40-year olds are producing less than the optimal healthy levels of HCL required for optimal digestion and nutrient absorption.

#### WHAT ARE THE SYMPTOMS OF REDUCED OPTIMAL HCL?

The outward signs that HCL production is reduced are:

- (a) Abdominal Pain
- (b) Distention

- (c) Bloating
- (d) Nausea
- (e) Flatulence
- (f) Vomiting

#### **WHAT CAUSES ATROPHIC GASTRITIS?**

**Inflammation in the fundus and antrum areas of the stomach is likely from infiltration of macrophages and lymphocytes against erosive factors such as non-steroidal or prescription steroidal anti-inflammatory drugs, Helobacter Pylori or other pathogenic microorganism invasion during high pH vulnerability opportunity. Anything that arouses inflammation of this area in the stomach reduces the rate at which the stomach parietal cells can produce gastric acid.**

#### **WHY B-12 & FOLATE ABSORPTION IS REMARKABLY REDUCED IN LOW GASTRIC ACID STOMACH (ACHLORHYDRIA OR HYPOCHLORHYDRIA)**

**Reduced gastric acid rate proportionately reduces absorption of vitamin B-12 and Folate from either foods or supplements are absorbed. The two are inseparably dependant upon each other. The acid-producing parietal cells of the stomach also produce the “intrinsic factor”. To the degree that inflammation inhibits production of HCL is proportionate to inhibited production of the “intrinsic factor”. In the absence of or diminished amounts of HCL, microbial overgrowths compete for B-12 absorption. The metabolism of B-12 and Folate is related since in order for Folate to access human tissue, B-12 is required. This is reflected on the level of Folate in red blood cells, (not folate levels in serum). Both Folate and B-12 levels are required for red blood cell production and are directly responsible for red blood cell quality. Hence epidemiological subclinical deficiency of Folate & Vitamin B-12 occurs in 15-40% of the entire population with even higher deficiency reported among those over age 50 (National Diet & Nutrition Survey 1994 & 1995). Furthermore the National Health and Nutrition Examination Survey (NHANES III 1988-91) and the Continuing Survey of Food Intakes by Individuals (1994-96 CSFII) indicated that most adults do not consume adequate folate. If folate and Vitamin B-12 intake are not continuously sustained through food and supplement intake then absorbed through a health normal gastric acid medium the quality and quantity of oxygen carrying red blood cells may be significantly lower than optimal.**

#### **WHO IS AT RISK AND WHAT IS THE SOLUTION?**

**Any one with occasional or frequent gastro-intestinal stress may be at risk for low absorption of Vitamin B-12 and Folate resulting in poor red blood cell health. The immediate resolution is to consume sublingual 200 micrograms Vitamin B-12 and 800 micrograms Folic Acid (Folate) daily. To resolve suspected achlorhydria or hypochlorhydria 2 grams of betaine HCL should be consumed with each meal. To resolve anti-microbial proliferation issues, Allicin from garlic, Berberine from Goldenseal, and Cinnamaldehydes from cinnamon are recommended as tolerated. The addition of sublingual Vitamin B-12 & Folate present both health and performance micro-dose influences in metabolism without which each is dramatically reduced.**

#### **References**

Plummer N. *The Unseen Epidemic: The Linked Syndromes of Achlorhydria and Atrophic Gastritis*. Townsend Letter. July 2004;#252: 89-94.

Taylor DN, Blaser MJ. 1991 *Epidemiol Rev* 13:50.

National Diet & Nutrition Survey 1994 & 1995

<http://www.statistics.gov.uk/STATBASE/Source.asp?vlnk=418&More=Y>

Raiten DJ and Fisher KD. Assessment of folate methodology used in the Third National Health and Nutrition Examination Survey (NHANES III, 1988-1994). *J Nutr* 1995; 125:1371S-1398S.

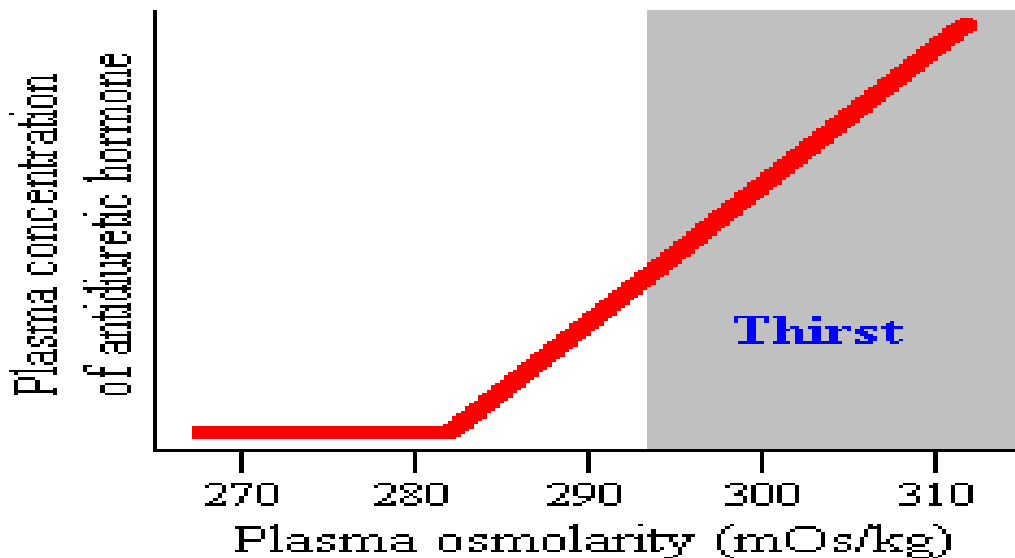
**THE IMPORTANCE OF VITAMIN B-12 & FOLATE VIA SUBLINGUAL ROUTE**

Bill Misner Ph.D. article written for New Sublingual B-12/Folic Acid product for E-CAPS Inc.

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**#9 What increases thirst (besides dehydration) during a hot endurance event?**

As seen the figure below, antidiuretic hormone concentrations rise steeply and linearly with increasing plasma osmolarity, which serves to drive the thirst reaction ↑.



Antidiuretic hormone, also known as vasopressin, is a nine amino acid peptide secreted from the posterior pituitary. Within hypothalamic neurons, the hormone is packaged in secretory vesicles with a carrier protein called neurophysin, and both are released upon hormone secretion. Roughly 60% of the mass of the body is water, and despite wide variation in the amount of water taken in each day, body water content remains incredibly stable. Such precise control of body water and solute concentrations is a function of several hormones

acting on both the kidneys and vascular system, but there is no doubt that antidiuretic hormone is a key player in this process.

#### **PHYSIOLOGIC EFFECTS OF ANTIDIURETIC HORMONE EFFECTS ON THE KIDNEY**

The single most important effect of antidiuretic hormone is to conserve body water by reducing the output of urine. A diuretic is an agent that increases the rate of urine formation. Injection of small amounts of antidiuretic hormone into a person or animal results in antidiuresis or decreased formation of urine, and the hormone was named for this effect. Antidiuretic hormone binds to receptors in the distal or collecting tubules of the kidney and promotes resorption of water back into the circulation. In the absence of antidiuretic hormone, the kidney tubules are virtually impermeable to water, and it flows out as urine. Antidiuretic hormone stimulates water reabsorbing by stimulating insertion of "water channels" or aquaporins into the membranes of kidney tubules. These channels transport solute-free water through tubular cells and back into blood, leading to a decrease in plasma osmolarity and an increase osmolarity of urine. Effects on the Vascular System In many species, high concentrations of antidiuretic hormone cause widespread constriction of arterioles, which leads to increased arterial pressure. It was for this effect that the name vasopressin was coined. In healthy humans, antidiuretic hormone has minimal pressor effects.

#### **CONTROL OF ANTIDIURETIC HORMONE SECRETION**

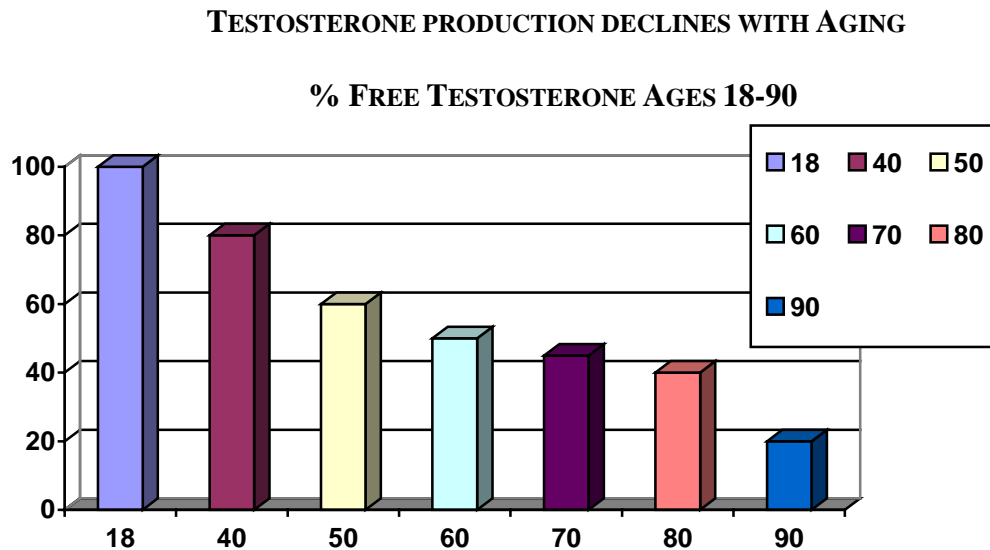
The most important variable regulating antidiuretic hormone secretion is plasma osmolarity, or the concentration of solutes in blood. Osmolarity is sensed in the hypothalamus by neurons known as osmoreceptors, and those neurons, in turn, stimulate secretion from the neurons that produce antidiuretic hormone. When plasma osmolarity is below a certain threshold, the osmoreceptors are not activated and antidiuretic hormone secretion is suppressed. When osmolarity increases above the threshold, the ever-alert osmoreceptors recognize this as a cue to stimulate the neurons that secrete antidiuretic hormone. Osmotic control of antidiuretic hormone secretion makes perfect sense. Imagine walking across a desert: the sun is beating down and you begin to lose a considerable amount of body water through sweating. Loss of water results in concentration of blood solutes - plasma osmolarity increases. Should you increase urine production in such a situation? Clearly not. Rather, antidiuretic hormone is secreted, allowing almost all the water that would be lost in urine to be reabsorbed and conserved. There is an interesting parallel between antidiuretic hormone secretion and thirst. Both phenomena appear to be stimulated by hypothalamic osmoreceptors, although probably not the same ones. The osmotic threshold for antidiuretic hormone secretion is considerably lower than for thirst, as if the hypothalamus is saying "Let's not bother him by invoking thirst unless the situation is bad enough that antidiuretic hormone cannot handle it alone." Secretion of antidiuretic hormone is also simulated by decreases in blood pressure and volume, conditions sensed by stretch receptors in the heart and large arteries. Changes in blood pressure and volume are not nearly as sensitive a stimulator as increased osmolarity, but are nonetheless potent in severe conditions. For example, Loss of 15 or 20% of blood volume by hemorrhage results in massive secretion of antidiuretic hormone. Another potent stimulus of antidiuretic hormone is nausea and vomiting, both of which are controlled by regions in the brain with links to the hypothalamus [1].

## Reference

[1] By permission, courtesy of Professor R. A. Bowen D.V.M., Ph.D., Department of Biomedical Sciences, Colorado State University, Fort Collins, CO 80523; see *Fundamental Concepts in Endocrinology* @ <http://www.vivo.colostate.edu/hbooks/index.html>

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### #10 Does male testosterone decrease with age or overtraining, and if so, how much?



In order to provide a comprehensive account of pituitary-testicular function in man, 466 subjects, ranging in age from 2 to 101 years, were studied to examine blood levels of the pituitary gonadotrophins (LH and FSH), the sex steroids testosterone and estradiol, the binding capacity of the sex hormone binding globulin (SHBG), the free testosterone and estradiol fractions, and the transfer constant for the peripheral conversion of testosterone to estradiol. The results were compared with clinical indices of testicular size, sexual function and secondary sex hair distribution. Testosterone levels fell slowly after the age of 40. Testosterone showed small seasonal variations in young adult men, the lowest values being seen in winter. SHBG binding capacity was high in two prepubertal boys, fell in adult men, but increased in old age. Free testosterone and estradiol levels fell in old age. The metabolic clearance rates of testosterone and estradiol fell in old age, while the conversion of testosterone to estradiol increased with age. The evidence is consistent with a primary decrease in testicular function over the age of 40 years (1).

Plasma testosterone (and other steroid hormones) were measured in 94 normal adult men aged 20 - 99 using RIA methods after chromatographic separation of steroids on Sephadex LH-20 columns. Plasma testosterone decreased significantly with age. The age related changes of plasma testosterone in elderly men was suggestive of decreased testicular function with increased peripheral conversion of androgens into estrogens. Increased estrogen levels in aging males may be able to inhibit the production of testosterone in the

testes (2).

Decreases in plasma testosterone values occur in males between the ages of 50 and 60. Part of this decline occurs as a result of decreased ability of the testes to synthesize testosterone. The response of the anterior pituitary gland in older men appears to remain normal. Increasingly with age, androgens are converted to estrone and estradiol (in males). Free testosterone decreases because of increased sex hormone binding globulin levels (3).

The effects of old age, chronic disease, and stress on testicular function were examined in Syrian hamsters living on a 12-hr photoperiod. Plasma testosterone concentrations and testes weights were maintained in healthy hamsters 16-19 months of age, but chronic stress decreased plasma testosterone in these old hamsters and not in younger ones (8-11 months of age). Chronic disease in the form of congestive heart failure (CHF) in cardiomyopathic hamsters also decreased plasma testosterone and testes weights, although it is not clear what aspects of this disease affected testicular function. There was an interaction between disease and stress, in that chronic stress produced lower plasma testosterone and testes weights in hamsters with heart failure than in age-matched stressed, healthy hamsters. It appears that younger hamsters can maintain reproductive function during stress, but older ones may not be able to do so. Congestive heart failure in hamsters clearly impairs normal reproductive function by itself; it also makes them more susceptible to stress, so that combining stress and disease results in almost complete suppression of plasma testosterone levels (4).

The concentration of sex and gonadotropic hormones in blood plasma of 280 reasonably healthy men aged 20-105 was determined using radioimmunoassay kits. Compared to men aged 20-39, a statistically significant decrease in testosterone level was registered in men aged 55-59 (5).

By the time men reach their fifties and sixties, their bodies may contain as little as half of the free, unbound testosterone compared to their level in their twenties (6).

This study found that total male testosterone levels decline by an average of 0.2% per annum over a period of 13 years. Most other studies have shown greater annual decline than 0.2%. This may be explained because this study measured total testosterone (instead of, and more relevantly) free testosterone (7).

The 24-hour mean plasma concentrations of androgens (dihydrotestosterone and total and free testosterone), estrogens (estrone and estradiol), and gonadotropins (LH and FSH) were measured in 35 healthy men, aged 21-85 years, who were rigorously screened to exclude factors known or suspected to alter endocrine function. The plasma total testosterone concentration showed a slow continuous decline with age, decreasing approximately 35% between 21 and 85 years of age. The free testosterone level was closely correlated with that of total testosterone over the entire observed concentration range. Testosterone secretion appears to decline slowly and continuously throughout adult life in men (8).

Free testosterone declines in tandem with the progression of the aging process. One of the

reasons for this decline is increasing sex hormone binding globulin (SHBG) levels and declining albumin levels with age. These factors cause a decline in free testosterone. The author also notes that the decline in free testosterone that occurs with the aging process is greater than the decline in total testosterone (9).

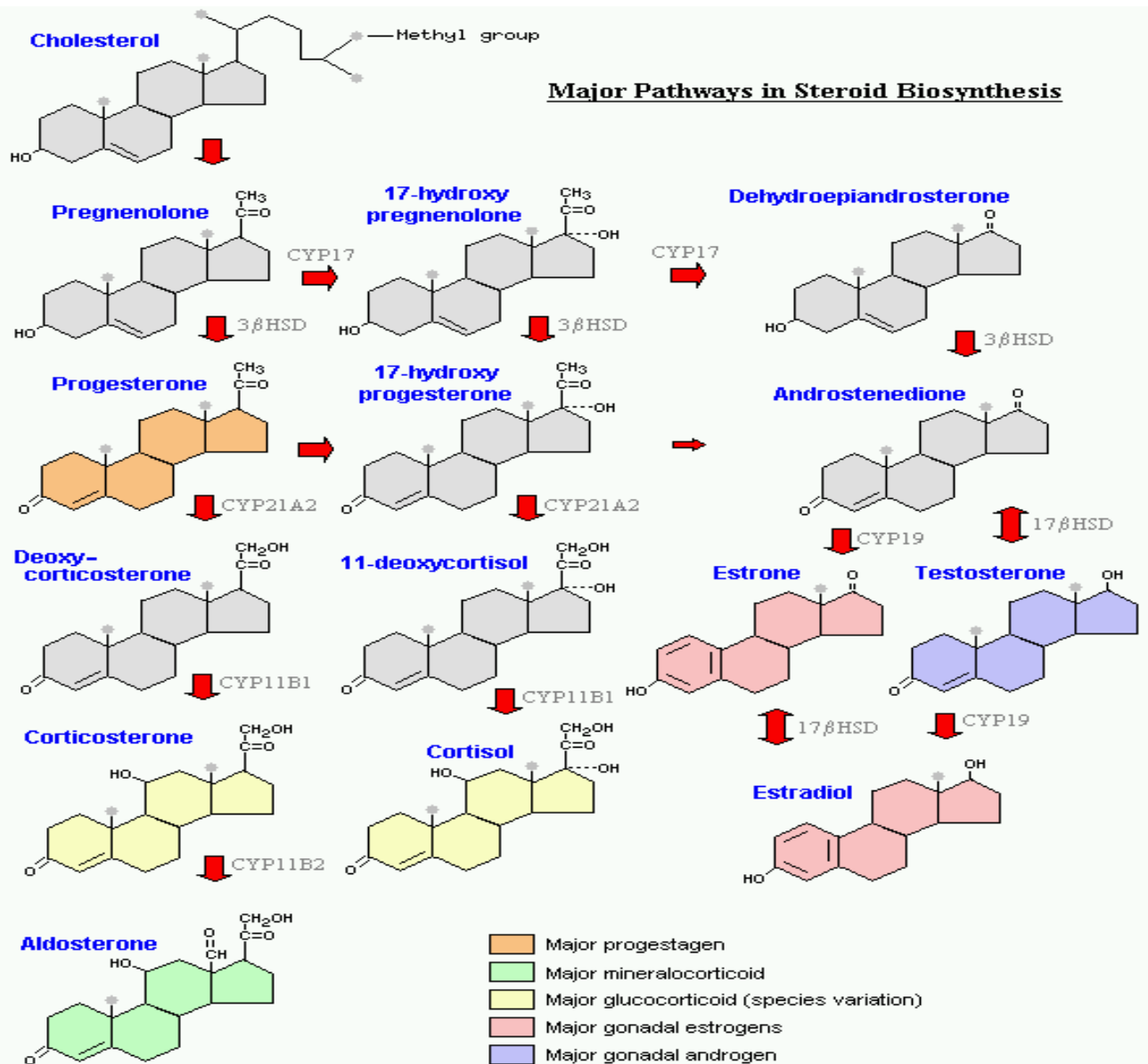
Human research demonstrates that free testosterone levels decline with age and the conversion of testosterone to estradiol increases with age. This decline produces measurable decline in testicular function after the age of 40. Part of this decline occurs as a result of decreased ability of the testes to synthesize testosterone. SHBG levels increase with age.

### **DOES OVERTRAINING DECREASE MALE ANABOLIC TESTOSTERONE?**

Male endurance athletes of all ages experience testosterone deficit. Testosterone deficit increases the risk of osteoporosis (10). During the last decade extensive research on the role of exercise upon the human reproductive system has been conducted. Primarily these investigations have focused on female subjects, but an increasing number of studies have examined male related issues. Evidence now suggests that men who participate in chronic endurance training display mild degrees of reproductive system abnormalities. The major abnormalities noted thus far are reduced resting levels of testosterone, altered pituitary release of luteinizing hormone and prolactin, and altered sperm characteristics (11, 12).

Anyone who overtrains, weightlifters or distance runners, is reported to produce less testosterone (13, 14, 15).

Roberts et al. substantiated the hypothesis that strenuous exercise disrupts the hypothalamic-pituitary-gonadal axis in men. Five endurance-trained men (maximum oxygen consumption  $65.4 \pm 3.6$  mL/kg per minute [means  $\pm$  SEM]) with normal spermatogenic and hormonal profiles were studied. Semen and blood samples were collected bimonthly before, immediately after, and 3 months after overtraining, which was defined as twice the previous average weekly training volume with unchanged intensity. Basal testosterone levels decreased to  $5.37 \pm 0.67$  ng/mL from  $8.68 \pm 0.93$  ng/mL immediately after overtraining and basal cortisol levels increased to  $215.3 \pm 31$  ng/mL from  $145.7 \pm 27$  ng/mL. This inverse relationship was highly correlated. Both cortisol and T levels returned to pretraining values 3 months after resumption of previous training volume. Sperm count ( $91 \pm 23.3 \times 10^6$ ) decreased significantly by 43% immediately after overtraining ( $52 \pm 6.8 \times 10^6$ ) and by 52% 3 months after overtraining ( $44.5 \pm 20 \times 10^6$ ). These results indicate that overtraining reduces testosterone levels, which is highly correlated with an increase in levels of cortisol and possibly a subsequent decrease in sperm concentration 74 days later (16).



**Enzymes required to synthesize the major steroid hormones.**

Common	"Old" name	Current
Side-chain cleavage enzyme; desmolase	P450 <sub>SCC</sub>	CYP11A1
3 beta-hydroxysteroid dehydrogenase	3 beta-HSD	3 beta-HSD
17 alpha-hydroxylase/17,20 lyase	P450 <sub>C17</sub>	CYP17
21-hydroxylase	P450 <sub>C21</sub>	CYP21A2
11 beta-hydroxylase	P450 <sub>C11</sub>	CYP11B1
Aldosterone synthase	P450 <sub>C11AS</sub>	CYP11B2
<b>Aromatase</b>	<b>P450<sub>aro</sub></b>	<b>CYP19</b>

## References

- (1) Baker, H. W., et al. Changes in the pituitary-testicular system with age. *Clin Endocrinol.* 5(4):349-372, 1976.
- (2) Drafta, D., et al. Age-related changes of plasma steroids in normal adult males. *J Steroid Biochem.* 17(6):683-687, 1982.
- (3) Kley, H. K., et al. [Sexual hormones in ageing males]. *Aktuelle Gerontol.* 6(2):61-67, 1976.
- (4) Ottenweller, J. E., et al. Ageing, stress and chronic disease interact to suppress plasma testosterone in Syrian hamsters. *Journal of Gerontology.* 43(6):M175-M180, 1988.
- (5) Moroz, E. V. Hypophyseal-gonadal system during male aging. *Arch Gerontol Geriatr.* 4(1):13-19, 1985.
- (6) Vermeulen, A. The male climacterium. *Ann Med.* 25:531-534, 1993.
- (7) Zmuda, J., et al. Longitudinal relation between endogenous testosterone and cardiovascular disease risk factors in middle-aged men. *American Journal of Epidemiology* 146:609-617, 1997.
- (8) Zumoff, B., et al. Age variation of the 24-hour mean plasma concentrations of androgens, estrogens, and gonadotropins in normal adult men. *Endocrinol Metab.* 54(3):534-538, 1982.
- (9) Dean, W. The male reproductive homeostat: neuroendocrine theory of aging - part VI. *Vitamin Research News.* May 2000:1-6, 16.
- (10) Bennell, K. L., et al. Effect of altered reproductive function and lowered testosterone levels on bone density in male endurance athletes. *British Journal of Sports Medicine.* 30(3):205-208, 1996.
- (11) De Souza, M. J., et al. Gonadal hormones and semen quality in male runners. *Int J Sports Med.* 15:383-391, 1994.
- (12) Hackney, A. C. The male reproductive system and endurance exercise. *Med Sci Sports Exerc.* 28(2):180-189, 1996.
- (13) Wheeler, G. D., et al. Reduced serum testosterone and prolactin levels in male distance runners. *J Amer Med Assoc.* 252:514-516, 1984.
- (14) Wheeler, G. D., et al. Endurance training decreases testosterone levels in men without change in luteinizing hormone. *J Clin Endocrinol Metab.* 42:422-425, 1991.
- (15) Hakkinen, K. A., et al. Relationships between training volume, physical performance capacity and serum hormone concentrations during prolonged training in elite weight lifters. *International Journal of Sports Medicine.* 8(Supplement):61-65, 1987.
- (16) Roberts, A. C., et al. Overtraining affects male reproductive status. *Fertil Steril.* 60(4):686-692, 1993.

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ARTICLES # 2

[NEW GLUTAMINE-ENHANCED HAMMER WHEY PROTEIN](#)  
[PREMIUM INSURANCE CAPS](#)  
[REM CAPS](#)  
[MITO-r-CAPS](#)

**ARTICLE #3**      **PREMIUM INSURANCE CAPS** (Phosphatidylserine (PS) is recently a phospholipid for use by athletes as a means to lower post-exercise cortisol. It is marketed as a "cortisol blocker".)

**ARTICLE #8**      **PREMIUM INSURANCE CAPS** contains both vitamin B-12 & Folate in the ideal 1:4 ratio at the ODA level dose. XOBALINE B-12 contains only B-12. We are completing work on a new sublingual B-12 Folate product.

**POSTSCRIPT:** All hormone protocol references cited above are intended to reflect keeping within high normal reference range avoiding hormone imbalances projected by endurance exercise's toll on the body exposed to extreme training. Balance is key with the objective being upper hormone normal reference range values. Too much of one or too little of another hormone can be harmful to both health and performance.

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