

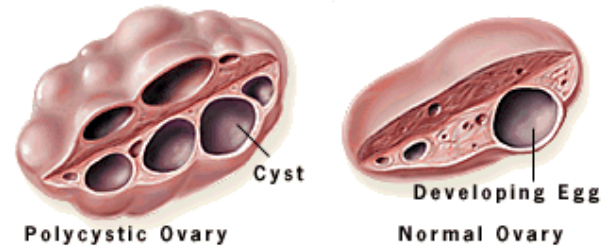
# Polycystic Ovarian Syndrome (PCOS) and Nutritional Supplementation ©

By Ladd R. McNamara, M.D.

## Introduction:

Polycystic ovarian syndrome (PCOS) is a multifactorial, reproductive and metabolic disorder that affects 5 – 12% of women of reproductive age, and even more alarming, some report the incidence as high as 15 – 20% of women when the European Society for Human Reproduction and Embryology/American Society for Reproductive Medicine criteria are used.<sup>1, 2, 3</sup>

This disorder has various manifestations; however, it is characterized by a traditional triad of chronic anovulation, polycystic ovaries and hyperandrogenism. In layman's terms, this all means no periods, multiple cysts in the ovaries, and signs of increased testosterone levels (acne, increased male-pattern hair, aka hirsutism, on the face and other areas, male pattern baldness or alopecia). Not all three traditional manifestations may be evident, making diagnosis challenging in some cases.



As a consequence of abnormal hormone release, PCOS is often accompanied by insulin resistance, leading to body fat accumulation, and global low-grade inflammation.<sup>4, 5</sup> If left unmanaged, these factors put a woman at a significant increased risk of Type 2 diabetes and cardiovascular disease.<sup>6-10</sup> Depression, anxiety, and mood swings are also commonly associated with PCOS.<sup>11, 12</sup>

As a result of these symptoms, a teenage girl or adult woman can be quite affected, both physically and psychologically by PCOS. It is quite distressing for a woman to deal with acne and hair growth on her upper lip and chin, as well as be confused about what is happening with her menstrual cycles. Early in the disease process, she might seek medical attention, and to her frustration not be adequately diagnosed or treated. Or, if correctly diagnosed not quite understand the significance of why she has this disorder, and what the long-term consequences are regarding pregnancy, and certainly not of her increased risk for type 2 diabetes or cardiovascular disease, including high blood pressure.

Usually, the doctor and the patient is highly focused on getting rid of the symptoms, and not truly grasp the long-term, more significant life-altering risks of type 2 diabetes or cardiovascular disease.

Treatment usually involves birth control pills. More doctors now understand the importance of managing insulin resistance. Of course, just as important to the patient are the visible and troubling concerns of acne and unwanted hair growth.

What I have discovered in 1995, after treating my PCOS patients with the traditional methods, that I was only treating the symptoms, and not treating the cause of the disease. Once I realized that I actually could treat the true cause of the disease, which involves the abnormal release of LH/FSH from the pituitary gland and insulin resistance, everything changed in the way I practiced, and in the results my patients experienced.

I provided a broad-spectrum of balanced micronutrients so that the patients' brains could function normally. I found that within 8 to 16 weeks of supplementing with high-quality, potent and pure nutritional supplement regimen, most patients (> 90%) will have started to experience their periods again, as well as had a resolution of most of their acne. The remaining 10% took a few months longer, but all of them had resolution. They also eliminated their insulin resistance, as witnessed with 2 hour glucose tolerance testing.

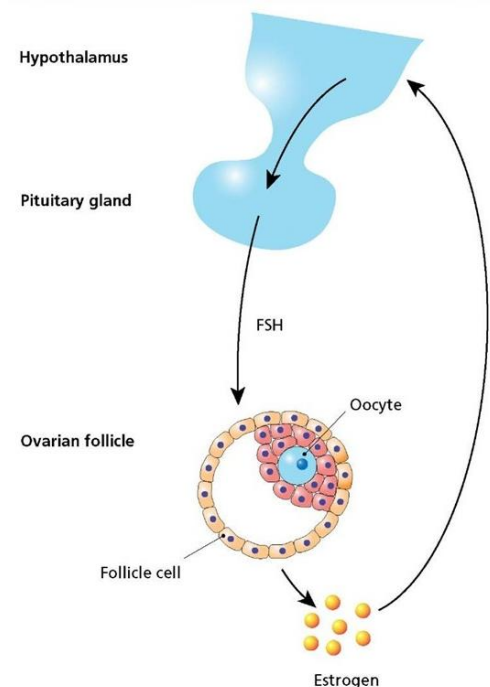
Most importantly, the patients that followed my recommendations for pharmaceutical-grade, broad spectrum dietary supplementation did not have to continue on birth control pills (unless they were using them for contraception), metformin, or the diuretic, spironolactone.

In this article, I will cover the testing that is done for diagnosis of PCOS, as well as the treatment management goals, along with the considerations regarding medication, vs. the alternative of taking safe and effective nutritional supplements.

### Hormone Production and Synchronization During a Normal Menstrual Cycles vs. PCOS:

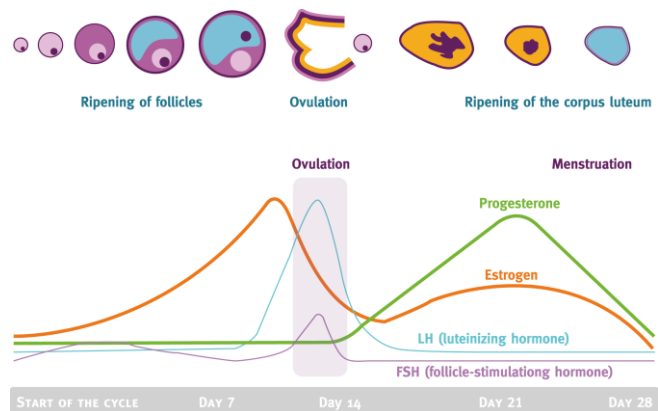
The normal balance, function and synchronization of the menstrual cycle involves a very complex, dynamic, and nearly miraculous interaction of the "hypothalamus-pituitary-ovary axis."

1. The **hypothalamus**, senses and regulates many functions of the body, including hormones. It acts like a thermostat to control the body's temperature, and in like manner receives biofeedback on multiple hormone levels. When estrogen blood levels dip down, it sends a pulsatile hormone signal of **gonadotropin releasing hormone (GnRH)** to the pituitary gland, beneath the hypothalamus, to produce FSH (and small amounts of LH, or Luteinizing Hormone).
2. The **pituitary produces FSH (Follicle Stimulating Hormone)** in a pulsatile manner, upon receiving pulsatile (GnRH) hormone stimulation from the hypothalamus, all due to low estrogen blood levels.
3. **Within the ovaries are follicles**, very small cysts each housing a dormant egg. Also, there are two main cell types comprising the follicle, granulosa cells that form the multi-layer follicular cyst wall of the follicle, and thecal cells inside near the egg. Thecal cells under LH stimulation produce androgens, including testosterone, and granulosa cells, under pulsatile FSH stimulation convert the androgens made by the thecal cells into estrogen. (The adrenal glands also produce testosterone.)
4. Follicles within the ovary slowly grow over time, to the point where when about 2 mm in size, one follicle is primed to be "recruited," or stimulated by FSH to be used for that particular menstrual cycle.
5. The granulosa and thecal cells of the recruited ovarian follicle, under influence of FSH and LH, respectively, grow, multiply, and develop. The increasing number of granulosa cells account for **increasing levels of estrogen, and increasing thecal cells account for rising**



**testosterone blood levels.** Testosterone production follows a similar curve to that of production of estrogen, including a mid-cycle spike in both hormone levels. This makes sense for multiple reasons, including the fact that more androgens are required to be converted into estrogen in the granulosa cells.

6. Rising estrogen levels have multiple effects. A few of those are:
  - a. Estrogen stimulates the uterine endometrial lining to thicken in preparation for implantation of the conceptus, or fertilized egg and resultant embryonic multi-cellular blastocyst.
  - b. **Estrogen levels rise, providing a “negative-biofeedback” to the hypothalamus to reduce GnRH production, which in turn reduces FSH production** from the pituitary.
  - c. **About 12 days into the cycle**, the hypothalamus (via unknown mechanisms) produces a sudden surge of GnRH, leading to a spike in pituitary LH production, known as an **“LH surge,”** along with an FSH surge.
7. Over the course of first 2 weeks of the menstrual cycle, known as the “follicular phase,” **the follicle matures and increases to about 2 cm in size**, at which point estrogen production reaches its peak. FSH levels are relatively low due to elevating estrogen blood levels. Due to low FSH blood levels, right before the mid-cycle LH surge, the follicular granulosa cells slow down their conversion of androgens into estrogen, and estrogen levels dip just a bit.
8. As mentioned already, around **day 12 of the cycle, the hypothalamus releases a burst of GnRH, stimulating a surge in pituitary production of both LH and FSH, or the “LH surge.”** The mechanism that actually triggers the LH surge is not fully known, but for whatever reason there appears to be a brief surge or change in the pulsatile GnRH production from the hypothalamus, which triggers the rapid spike in LH pituitary production. The LH surge sees a production from the pituitary of a blood level rise of 10 – 20 times above that of baseline. **This “LH surge” lasts for 36 to 48 hours**, after which LH slowly returns to lower levels, though for the following 2 weeks LH persists to be released from the pituitary, but with a different pulsatile rhythm than in the follicular phase, all controlled by the hypothalamus. After ovulation, following the LH (luteinizing hormone) surge, the second half of the menstrual cycle is known as the luteal phase.
9. **LH spike stimulates** the LH receptors on the thecal cells of the mature follicle to stimulate the **thecal cells to rapidly increase testosterone production**, along with triggering the release of the egg, or **ovulation about 24 – 36 hours later**.
  - a. Testosterone stimulates sexual desire, to “inspire” sex for pregnancy to result.
10. **After ovulation**, the follicle, now called the “corpus luteum,” continues to produce estrogen (which negatively feedbacks on the hypothalamus to prevent stimulating FSH production), but now also begins to use cholesterol to **produce progesterone**.



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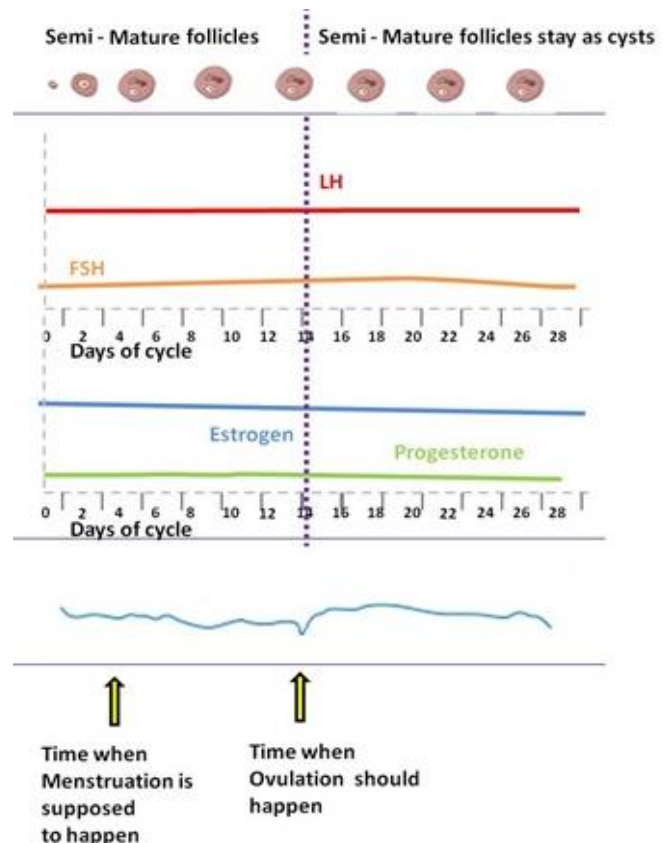
- a. Progesterone further develops and maintains the endometrial lining for so that it is optimal for implantation of the conceptus, which occurs about a 7 – 9 days after ovulation, coinciding with peak progesterone production from the ovary.
  - b. Progesterone also affects the hypothalamus to gradually alter and reduce the pulsatile release of GnRH in such a way as to support the corpus luteum and endometrial lining by altering the LH pulsatile production from the pituitary.
11. In the case of pregnancy, with implantation at the multi-cellular blastocyst stage, the developing embryo releases human chorionic gonadotropin (hCG), which acts like LH on the corpus luteum, stimulating progesterone production until the placenta is developed enough to take over that role.
  12. If there is no conception and implantation, then **10 – 12 days after ovulation the corpus luteum starts to wither, and progesterone and estrogen production rapidly declines.** Without progesterone to maintain the endometrial lining, **menses ensues.**
  13. Day 1 of the menstrual cycle, the first day of menses, begins again. Estrogen and testosterone levels are at their lowest levels; and progesterone is also low or undetectable. **The hypothalamus sensing low estrogen blood levels, begins to produce GnRH to stimulate pituitary FSH production, and the cycle continues.**

### Hormone Production and Desynchronization in Women with PCOS:

In the case of women with Polycystic Ovarian Syndrome, there is a range from irregular menses (oligomenorrhea) to no menstrual cycles (amenorrhea). The hormone profile is quite different, and the dysfunction begins in the brain.

For unknown reasons (possibly a combination of oxidative stress, genetics, and insulin resistance) PCOS is triggered, and the hormone cascade from the hypothalamus-pituitary-ovarian axis is disrupted, with hypersecretion of LH and chronic elevation of testosterone, as well as estrogen with the resultant side effects.

1. The **hypothalamus produces gonadotropin releasing hormone (GnRH) in an irregular manner** (probably higher frequency and amounts), which stimulates the pituitary gland to chronically secrete luteinizing hormone (LH).
2. **With chronically-elevated LH levels there is no LH surge to trigger ovulation.** FSH is also secreted at minimal levels because estrogen is chronically high due to the multiple ovarian follicular cysts producing it.



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3. There are **occasional rises in FSH** when estrogen levels dip down, and a new follicle is stimulated to grow, but never matures or ovulates; i.e., **multiple cysts**.
4. Chronically-elevated LH stimulates the thecal cells in the follicle to produce testosterone.
  - a. **With multiple cysts, testosterone levels remain chronically elevated.**
5. Testosterone is released into the blood, as well as converted into estrogen by the granulosa cells, and released into the bloodstream.
  - a. **Elevated testosterone stimulates hirsutism**, or unwanted male-pattern facial hair growth (on upper lip and chin), and possibly increased hair growth on the lower abdomen, chest, back, fingers and toes.
  - b. Testosterone is converted by 5 alpha-reductase enzymes in the skin into dihydrotestosterone (DHT). **DHT stimulates hair follicles** (male pattern hair growth) **and sebaceous glands (skin oil), leading to acne.**
6. **Chronically-elevated estrogen** levels contribute to changes in glucose/insulin interaction, and chronic low-grade inflammation causes oxidative stress, damaging insulin receptors, **causing more and more insulin resistance.**
7. Glucose levels rise higher than normal, and remain elevated longer than normal after eating, causing further inflammation to arterial walls and insulin receptors.
  - a. **The woman gains weight**, and can become obese.
  - b. She also is **at increased risk for type 2 diabetes and cardiovascular disease.**
8. Without an LH surge to trigger ovulation, the follicular cyst never converts to a corpus luteum, and **progesterone is not produced** (to any significant levels).
9. Since there is no progesterone rise (for 10 to 12 days) and fall, the endometrial lining of the uterus is never shed off to cause bleeding. **Therefore, no period; "amenorrhea."**
  - a. Some women do experience irregular periods, or "oligomenorrhea," because occasionally the LH levels may fall and then surge, triggering ovulation, along with progesterone secretion and withdrawal 12 days later, which triggers bleeding, or menses.
  - b. The young woman first notices irregular, or a complete absence of periods, followed by increasing acne, and then facial hair growth.

### Testing for Diagnosis:

Laboratory findings will vary, which makes the diagnosis a process of considering patient's clinical history, physical findings, and laboratory results. It may be necessary to rule out adrenal and/or pituitary disorders. Testing must be done only after 3 months without use of hormone contraceptives, as estrogen and progestin (synthetic progesterone) from birth control pills feedback on the hypothalamus to reduce GnRH production, and lower FSH and LH. Elevated total testosterone identifies an increased production from the multiple cysts in the ovaries.

**Total testosterone levels will usually be elevated, but at 150 mcg/dl or lower.** Total testosterone is more valuable for diagnosis of PCOS than free testosterone,<sup>13</sup> even though only the free testosterone is active to cause hirsutism and acne (and sex drive in general). Total testosterone greater than 200 mcg/dl, which could cause visualization (deepening of the voice, increased body musculature, and enlarged clitoris) warrants investigation into an ovarian or adrenal tumor.<sup>14</sup> Another androgenic hormone, DHEA-S, will be normal or slightly elevated. DHEA-S levels above 800 mcg/dl warrant investigation for an adrenal tumor.

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Pituitary prolactin levels can be slightly elevated, and is common in PCOS, but are not part of the syndrome itself. If prolactin levels are significantly elevated, or are persistently elevated then a pituitary tumor, or prolactinoma should be considered. This finding would be independent of PCOS.

A 24-hour urine collection might reveal mildly elevated cortisol levels. However, if cortisol levels are twice the upper limit of normal, the adrenal disorder, Cushing syndrome must be considered. Cushing syndrome is an overproduction of adrenal steroids, which results in abnormal glucose-insulin interaction, actions on fat cell hormones, and fat deposition and resultant weight gain.

**A luteinizing hormone - follicle stimulating hormone (LH/FSH) ratio of 2 or greater is highly suggestive of PCOS.**

**A pelvic ultrasound usually reveals multiple cysts within the ovary**, but since over 20% of women without PCOS have multiple cysts, the presence of multiple cysts is not diagnostic in and of itself. However, women with PCOS will usually have either 12 or more cysts within an ovary, of 2 – 8 mm in size; or fewer smaller cysts, but an overall increased total ovarian size of greater than 5.5 cm<sup>2</sup>.

### **Diagnosis:**

There is not a clear consensus on which findings are needed to make a clear diagnosis, so usually the diagnosis is made by consensus of findings, having ruled out other disorders. However, there is a proposal that a clear diagnosis for PCOS can be made under either of the following conditions:<sup>16</sup>

Any one of the four classic symptoms (menstrual disturbance, hirsutism, acne, or anovulatory infertility), along with either of the following:

1. Ultrasound findings of polycystic ovaries or enlarged ovaries (greater than 5.5 cm<sup>2</sup>).
2. Normal ovaries, but with any one or more of the following laboratory findings:
  - a. Elevated LH
  - b. Fasting glucose/insulin < 4.5
  - c. Elevated testosterone

### **Traditional Medical Management:**

The management of PCOS is focused on four aspects:

1. Control of menstrual cycle with birth control pills.
2. Treatment of hirsutism with birth control pills, shaving, plucking, or laser, and/or spironolactone.
3. Management of anovulatory infertility with Clomid, or similar ovulation-inducing medication.
4. Insulin resistance with metformin, along with a low-glycemic diet, exercise, and weight loss.

### **Management vs. Reversing PCOS:**

Managing PCOS is done with drugs. It does not restore the hypothalamus-pituitary-ovarian axis to normal hormonal functioning, it merely blocks certain pathways, bio-feedback, effectively masking the problem to reduce the signs and symptoms of PCOS. Reversing PCOS, and restoring the body to its normal state is accomplished with micronutrients: vitamins, minerals, antioxidants, and omega-3 fatty acids. There is scientific evidence supporting how and why a particular vitamin and mineral works to reduce the process of PCOS, which led me to apply micronutrients as a treatment for my patients with PCOS, but there is no study in existence that has looked at the combination of micronutrients, particularly with the quality, potency, and purity and broad spectrum use of pharmaceutical-grade micronutrients that I recommended. The results that my patients, and hundreds (if not thousands) of other women have experienced with this regimen over the past 20 years, has proven to them and me that this is the 'correct' way to manage PCOS. These women have described this micronutrient method of managing, or should I say, eliminating PCOS, as 'life changing.'

Birth control pills are used as the primary focus to manage the signs and symptoms of PCOS. I understand that many women have no concerns about taking birth control pills, and simply use them for contraception anyway. This is not to say that birth control pills do not have any risks, including both short and long-term risks, such as blood clots, stroke, and breast cancer.

I am not suggesting that women not use birth control pills as contraception, but just know that if preventing birth is not a consideration, there are safe alternatives, and certainly more healthier ways to control the menstrual cycle in a woman with PCOS, and that would be to normalize her periods by restoring the normal hypothalamus-pituitary-ovarian axis functioning.

Actually, if it is actually possible to reverse and eliminate PCOS, and restore the brain and body functions to normalcy with safe micronutrients it would not just be an "alternative" approach to manage this disorder, it would be the only true and proper approach. My claim is that not only is it possible to restore the brain and body to normal functioning with vitamins, minerals, antioxidants, and omega-3 fatty acids, I have actually successfully done it!

Every patient with PCOS who followed my protocol, and every woman who has not been my patient whom I have recommended this protocol has had significant success. It is not imaginary, it is not 'foo foo medicine,' it is 100% science based, and the physiologically correct way to restore cellular functions.

I remember the shift I had in the way I treated my patients with PCOS more than 20 years ago; going from the traditional methods that I had been taught, managing with birth control pills and spironolactone to instead treating with nutritional supplements, and witnessing resolution of PCOS and an overall health improvement in energy, complexion, and mood. My thought was to stop masking the symptoms of the disorder, and fix the root cause! Start by healing the brain (hypothalamus and pituitary) hormone production and secretions, and at the same time reduce inflammation, reverse insulin insensitivity, and eliminate acne and hirsutism.

The thought to do this was like a sudden light had gone off above my head, and deep down I knew this was correct approach. The results proved to me, and the patients that this was the answer to the problem. This is known as evidence-based medical approach; i.e., it was safe and it worked!

### **Correcting Physiological Abnormalities with Nutritional Supplements:**

Supplementing with proper micronutrients, in proper amounts, purity, and balance restored the normal hypothalamus-pituitary-ovarian axis interplay of hormones. Women first noticed to start dropping unwanted weight and resolution of acne. Next came a return of their periods, which meant they were ovulating, and the hormone cascade was indeed normal. At the same time insulin resistance was eliminated. Over the course of months, they experienced lighter and less unwanted hair growth as the androgenic side effects dissipated.

These women who had an elimination of PCOS with micronutrients also obtained was the reduction of overall low-grade inflammation that had been “slow cooking” the insides of their arteries, and the reduction in risk of type 2 diabetes and cardiovascular disease.

The body is not deficient in drugs. The body is usually in need of optimal micronutrient cellular nutrition. Today, with over 90,000 chemicals being emitted into our world let alone the genetic alterations in food, etc., we are exposed to an overload of toxins from our food, water, air, medications, and manufactured materials, at the same time we are getting less than adequate micronutrients in our diet; or at least not enough to counter the toxic chemical overload.

Many of these toxins, like PCBs and dioxins, accumulate in the fat, including the brain which is mostly made out of fat. Many of these toxins are fat soluble, and accumulate in fatty tissues, including the brain. Since the delicate neurotransmitter interactions and hormone secretion and regulation rely on the cells getting micronutrients, and we cannot get all that we need today from our food, nutritional supplementation becomes a must for all of us!

**The omega-3 fatty acids, such as fish oil**, is incredibly important for the brain to function properly. The omega-3 fatty acids found in fish oil, EPA and DHA, help with cognition, memory, mood stabilization, and brain hormone function and balance. This is what is disrupted in women with PCOS. Fish oil, and other micronutrients are needed to support and maintain cellular function throughout the body.

I put it to my patients this way; you can take pills, ... medications to treat diseases, from PCOS, to diabetes, high blood pressure, arthritis, high cholesterol, etc., or you can take other pills ... nutritional supplements, to prevent and/or reverse the development and progression of nearly all diseases. Medications, if taken properly have mild to serious side effects, including death. Nutritional supplements, if taken properly have no side effects, other than true health. Nutritional supplements, if taken in proper ratios, balance, purity, and potency, manufactured to pharmaceutical standards, make a huge difference in people’s health; including supporting normal brain function for mood and hormone secretion and regulation.

If the brain cells are getting the proper micronutrients for DNA-RNA-protein synthesis, as well as trace minerals for catalysts to enzymatic reactions, and hormone fat-protein neurotransmitters and receptors to all function as they should, then health is the result! Antioxidants, in many different varieties work synergistically to reduce both acute, and chronic inflammation that accompanies PCOS, and so many other diseases.

Cardiovascular disease is a disease initiated and propagated directly due to oxidative stress and inflammation. Oxidized LDL cholesterol is what sticks to the arterial walls and forms



plaque. Type 2 diabetes is initiated and propagated by oxidative damage and inflammation to insulin receptors. Cancer is initiated by DNA mutations, caused by oxidative damage! Antioxidants induce apoptosis, or the self-destruction of cancer cells.

Arthritis is an inflammatory disease, brought on by oxidative stress, as is dementia, and all autoimmune diseases. Reducing oxidative stress and inflammation with antioxidants is not only critical for women with PCOS, proper nutritional supplementation is essential for every single person, since almost all of us will face a chronic disease at some point in life. We just want to make these diseases happen much later than earlier (if at all), and reduce the impact on our quality of life as much as possible.

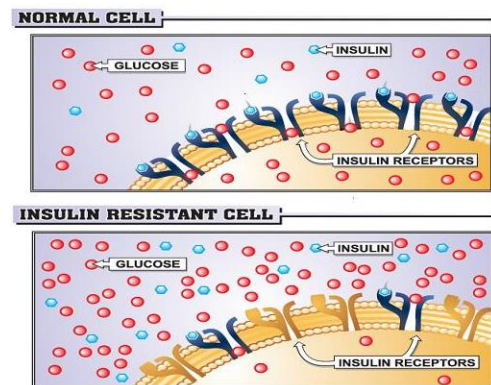
### **Oxidation Stress: The Main Pathophysiological Process of Nearly All Diseases**

Oxidative stress, caused by free radicals triggers and propagates almost all diseases. Insulin resistance and type 2 diabetes are sequela of PCOS. For those who wish to understand how oxidative stress leads to insulin resistance and type 2 diabetes, I will explain how free radicals damage insulin receptors. Once anyone understands this process, it will be very clear how and why antioxidants help reverse insulin resistance, and in my experience, even type 2 diabetes!

All cells have insulin receptors that are in the cell membrane. Insulin connects with insulin receptors, which then open channels to allow glucose to enter the cell, and proceed on to the mitochondria, to combine with oxygen. Inside the mitochondria is where metabolism occurs to convert glucose and oxygen into ATP energy molecules and CO<sub>2</sub>. (During the process of metabolism, free radicals are generated.)

Insulin receptors are made of proteins. Proteins are made of amino acids, which are made of molecules, and then atoms. Atoms have protons, neutrons, and electrons. All protein molecules have a distinct and unique 3-dimensional configuration held together by the electronic charges of the atoms of the protein molecule. It is exactly the 3-dimensional configuration that determines the function of the protein(s), whether the proteins are part of an enzyme, hormone, or hormone receptor. Anything that disturbs or changes the shape of the protein molecule(s) alters the functionality of the enzyme, hormone, or hormone receptor. The change in 3-dimensional shape of the protein(s) usually makes the enzyme, hormone, or hormone receptor near useless, or completely useless.

The immune system produces antibodies to scout and trap “foreign” proteins all throughout the body. Foreign proteins are any proteins that are not produced by the body; which includes viruses, bacteria, pollen, and other cells from other human beings, which have their own unique proteins within the cell membrane. (This is why blood transfusions must be matched, with the major protein antigens, A and B. “O Blood type” is merely the absence of A or B proteins. Rh is yet another protein. A person with O blood type will produce antibodies to the foreign A and B proteins, and attack and destroy those red blood cells. It is the 3-dimensional structure of each protein that identifies it as unique, and gives the molecule its function.



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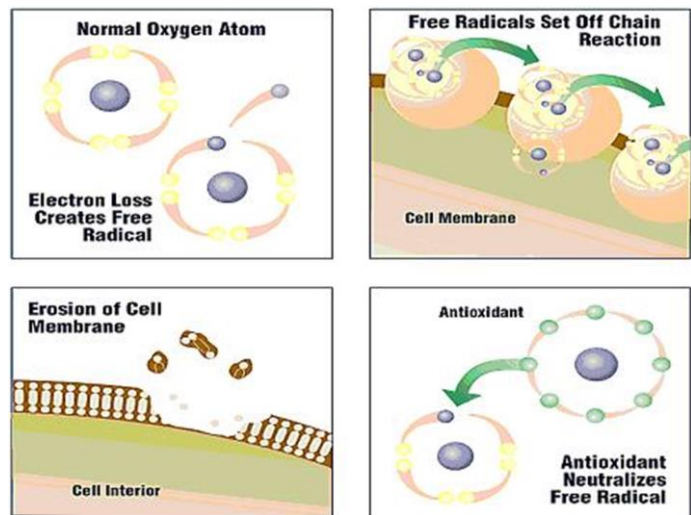
Anything that changes the 3-dimensional shape of your own proteins will not only cause a dysfunction of that protein, but will cause the immune system's antibodies to attack and destroy. Insulin resistance and type 2 diabetes, which is just a severe form of insulin resistance, occurs when insulin receptor protein molecules have their 3-dimensional shape changed, rendering them dysfunctional or totally nonfunctional. Insulin either cannot bind to the damaged insulin receptors, because they are distorted, or the receptors cannot function properly to open the glucose channels to allow glucose into the cell. The distortion, or change in shape of the insulin receptor molecule is now "foreign" in appearance (or shape) than what is normal, and antibodies attack the insulin receptors.

When antibodies attack and attach to foreign proteins, whether it is truly foreign or your own body's cellular proteins, it induces a white blood cell (WBC) response to surround, engulf, and "swallow" the foreign proteins; upon which it begins to dissolve the protein molecules. The WBC's use hydrogen peroxide ( $H_2O_2$ ) to destroy the proteins .... through free radical destruction, as  $H_2O_2$  is a free radical, and a natural Reactive Oxygen Species (ROS) chemical. The release of  $H_2O_2$  is part of the inflammatory response, and one way in which oxidative stress causes an inflammation. Insulin receptors now are abnormally-shaped, because they have been changed by oxidative stress, which induces an inflammatory response which further gets in the way of the normal insulin - insulin receptor function.

### Free Radicals Steal Electrons:

The cause of oxidative stress, the way that any protein molecule's 3-dimensional shape has been altered is by free radicals. Free radicals are any atom or molecule with an unpaired electron(s). This is a state of imbalance, and the free radical will steal electrons from any other atom or molecule, e.g., receptors, cell membranes, etc., in order to balance the electronic charge.

Oxidation, or oxidative stress, which is the stealing away of electrons from other atoms or molecules, was named after oxygen, as the oxygen molecule is made up of 2 oxygen atoms, or  $O_2$ .  $O_2$  is constantly combining, and sharing electrons to maintain electrical neutrality, or separating for nanoseconds into two lone oxygen atoms with unpaired electrons; which is unstable and seeks pairing with any electron available. Lone oxygen atoms are called free radicals, and they will either bond together with other oxygen atoms and be electronically neutral, or steal away electrons from other molecules or atoms, changing their electronic charge. Oxidation of metal is rust, e.g., free radical oxygen atoms have "stolen" electrons from iron atoms. Biological tissues don't rust, but are damaged.



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Free radicals, and Reactive Oxygen Species (ROS), chemicals that act as free radicals, steal away electrons from the atoms of proteins, fats, glucose, DNA, etc. throughout the body. As a result of stealing electrons, the electronic charge that holds the 3-dimensional shape of a molecule in place is disrupted, which changes the shape, or configuration of molecule. The distorted protein or DNA, no longer functions properly. The cell can make new proteins, such as insulin receptors, but if they get exposed to free radicals, they too are damaged and do not function correctly. Damaged insulin receptors are unable to allow glucose into the cell.

If there are too many oxidized, or damaged insulin receptors than there are functional insulin receptors to handle blood glucose levels, a situation of insulin resistance exists. If more insulin receptors are oxidized and damaged, i.e., non-functional, then hyperglycemia persists, and this is now referred to as type 2 diabetes. There is a massive amount of immune response to all the damaged insulin receptors, with concomitant inflammation, along with high blood sugar, which “sugar coats” more proteins in the arterial lining, allowing for easy oxidation and more inflammation (slow cooking of the arterial lining), as well as oxidation of LDL cholesterol, causing acceleration of arterial plaque formation, and eventual certain cardiovascular disease.

Smoking produces reactive oxygen species (ROS) molecules that damage the lungs, arterial lining, LDL cholesterol, and more. The more one smokes the more oxidative stress and inflammation, which increases the risk for lung cancer and other lung diseases, cardiovascular disease, stroke, type 2 diabetes, hypertension, cervical cancer, and more. Stress increases cortisol, which increases sugar and inflammation, along with oxidative damage. This is why stress is associated with an increased risk of diseases.

UV light from the sun produces free radical damage in the skin. Excessive sun exposure leads to excessive oxidative damage, leading to wrinkles as elastin and collagen are damaged, and cannot function properly, along with an increased risk of skin cancer.

Most toxic chemicals in the air, food, and water act as ROS, and set off a chain reaction of oxidative stress and inflammation. Excessive toxic exposure leads to disease.

### **Antioxidants Neutralize Free Radicals and Reduce Oxidative Stress & Inflammation:**

The good news is that oxidative damage and inflammation can be curbed, and if there is not too much exposure to ROS, then oxidative damage can be minimized, and there is less chance of disease. Antioxidants neutralize free radicals and ROS because they readily give up, or donate their electrons. Various antioxidants work synergistically to keep antioxidants viable with plenty of electrons to be able to neutralize free radicals and reduce oxidative damage to biological tissue, cell membranes, fats, hormone receptors, hormones, and enzymes. For example, vitamin C replenishes vitamin E and grape seed extract, allowing those antioxidants to last longer, and therefore be more effective.

Antioxidants have a finite ability to donate electrons, and after giving up the electrons that are available, are used up. This is one of the reasons why **nutritional supplements must be taken at least twice daily**, as most vitamins, minerals, antioxidants, and omega-3 fatty acids are used up within 8 to 12 hours. Free radical damage is happening every second, 24 hours per day; both intrinsically with cellular metabolism, and any disease process that involves inflammation, as well as extrinsically, through exposure to toxic substances. If supplements are taken once per day, then only half the day that person is getting some protection to minimize



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oxidative stress, and the other half they are experiencing increased oxidative damage, which IS the disease and aging process.

In addition to neutralizing free radicals, many antioxidants, like **grape seed extract and turmeric extract (curcumin)** block the Cox 2 enzyme, which is involved in the inflammatory process. Cox 2 inhibitor drugs have been developed, many with toxic side effects, including death. The natural Cox 2 inhibitors, as mentioned, are effective, without toxic side effects.

Antioxidant vitamins also have benefits to the DNA beyond just neutralizing free radicals and reducing oxidative stress. They can switch on a normal process called apoptosis, or the self-destruction of cancer cells. The trace minerals zinc and selenium, in addition to being used in various cellular functions, also are used as catalysts for powerful endogenous enzyme antioxidants.

**In multiple ways, antioxidants prevent and/or slow the oxidative-inflammatory disease process of PCOS, insulin resistance, diabetes, cancer, cardio-vascular disease, etc., including wrinkling of the skin, and the overall aging process itself.** Nearly every disease, and every human being without a disease, will benefit from taking properly-balanced, broad-spectrum, potent and pure vitamins, minerals, antioxidants, and omega-3 fatty acids.

Antioxidants neutralize free radicals, preventing them from oxidizing insulin receptors (and all other cellular structures). The cell makes new insulin receptors which are now protected from oxidative damage, and with an intact and normal 3-dimensional structure, the insulin receptors are actually “sensitive” to insulin, and function normally. This not only reverses insulin resistance, but type 2 diabetes and metabolic syndrome. This is huge. It has been a ‘life changer’ for the many people I’ve helped in this manner.

For over 20 years, I have been recommending high quality, broad spectrum, potent and pure antioxidant supplements to insulin-dependent type 2 diabetics, as well as medication-managed type 2 diabetics, and those with insulin resistance, and witnessing normal blood sugar levels without any medication use at all! I have had patients requiring insulin injections to normalize their blood sugar be completely off all medications and maintaining normal blood sugar levels within 4 to 12 months. How quickly they see results is dependent upon how severe their disease is, how much oxidation and inflammation they are exposed to, their genetic factors, and how well they adhere to my nutritional supplement regimen. I use higher doses in cases where there is more oxidation and inflammation.

This is what Linus Pauling described as ‘orthomolecular medicine.’ It is using micronutrients, or “correctly structured molecules” that the body is designed to utilize, that we normally get at lower levels from our food, and use it at higher, but safe doses for the cells to repair themselves, and function normally. This is opposed to medications that alter the way cells function.

**My patients who were struggling with PCOS saw results very quickly.** Even though I am retired from practice, I still coach people who want my help on what they can do to take control of their health. (I do not give medical advice, as a person must receive that from their personal physician. This article is not meant to be interpreted as medical advice, only information that one can use to discuss with their doctor.)

Are supplements safe? Each year in the United States there are over 100,000 deaths from medications taken the way they are prescribed. There are over 16,000 deaths from over-the-

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counter pain medications (like acetaminophen and ibuprofen). However, the number of deaths from vitamins, minerals, antioxidants, and omega 3 fatty acids combined account for ZERO deaths per year on average! Weighing the risks and benefits, I would say the balance is very much tipped towards nutritional supplements as opposed to medications. Certainly, there is a place for medications, but why not make lifestyle changes, including supplementation, the first choice?

To my patients, myself, and to thousands of other women who were not my patients whom I have coached over the years, using natural, safe, and effective micronutrients that the body needs already, to actually reverse PCOS and insulin resistance, and restore the brain and body to normalcy, just makes much more sense than simply masking the problem. Once you know what is causing PCOS and worsening it, why not rectify that? Why use medications that simply alter or fool the natural functioning of the body?

Using nutritional supplements is not an “alternative” to medications, as they are not fooling or altering the natural functions of the body, they are replacing what the body requires to function properly, and since medications don’t do that, it is not simply an “alternative” approach. It is the proper approach!

### **Managing Hirsutism:**

Testosterone is converted in the skin of both women and men by an enzyme, 5 alpha-reductase, to a much more potent form of testosterone, dihydrotestosterone (DHT). DHT is responsible for stimulating the hair follicles in many areas of the skin, including the beard area, to grow unwanted hair. (Interestingly, DHT has the opposite effect on the scalp, causing the loss of hair in both men and women, but men have more 5 alpha-reductase enzymes in their skin than women.) DHT also stimulates sebaceous glands (skin oil), which increases the chances of acne development. Blocking the 5 alpha-reductase enzyme, reduces DHT production, and reduces unwanted hair growth and acne, and reduces hair loss on the scalp.

**Spironolactone** is a diuretic, that is often prescribed to women with PCOS to reduce hirsutism, or unwanted hair growth. Spironolactone acts both in the ovaries, reducing androgen production (testosterone), and in the skin, competitively attaching to androgen (DHT) receptors, effectively blocking DHT from exerting its action in the skin.<sup>17</sup> This reduces new unwanted hair growth and acne. It does not get rid of existing unwanted hair growth. It takes about 6 months before these effects are noticeable.

Spironolactone, is a drug, and since it works to alter the normal functions of the body, of course it has possible side effects, which include:

- Diarrhea
- Constipation
- Nausea and vomiting
- Abdominal pain
- Abnormal enlargement of breasts in men (gynecomastia)
- Impotence
- Irregular menstrual cycle
- Breast pain
- Lethargy
- Confusion

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- Seizures
- Headache
- Skin rashes
- Increased level of potassium in the blood (hyperkalemia).
- Decreased level of sodium in the blood (hyponatremia).
- Leg cramps
- Irregular Heart Beat (arrhythmia)
- Dizziness
- Changes in sex drive
- Hair loss (alopecia)
- Excessive hair growth
- Abnormal liver function
- Decreased numbers of white blood cells in the blood.

The body is not meant to use this or any other drug. We are not deficient in drugs. We are deficient in nutrients.

Obviously, in the case of PCOS there is a need to reduce unwanted hair growth and acne. This can be accomplished much more safely with herbs and micronutrients than with drugs and their concerning potential side effects.

For example, **saw palmetto** blocks the enzyme 5-alpha reductase, thereby reducing the conversion of testosterone into dihydrotestosterone (DHT). Less DHT in the skin means less unwanted hair growth and acne.

With the use of a special blend of saw palmetto with other micronutrients, along with potent and pure grape seed extract and fish oil, acne resolution begins within days, and continues to improve to near complete resolution within just a few short weeks to several weeks, depending upon severity and dose of micronutrients (grape seed extract) being taken.

Over the course of several months of regularly using my protocol of nutritional supplements twice daily, women are not only having normal menstrual cycles, they are have a noticeable reduction of unwanted facial hair growth, or hirsutism in general. As with spironolactone, the saw palmetto, grape seed extract, and fish oil regimen, along with other micronutrients in my protocol, the supplements do not get rid of existing unwanted hair, but it greatly reduces, if not eliminates new growth of unwanted hair.

### **Managing Insulin Resistance:**

**Metformin** is effective in reducing insulin resistance in most cases. It also may help reduce PCOS symptoms a bit. As for as drugs' side effects go, this drug is not too worrisome as other drugs, and is considered very safe. The most common side effects of metformin are:

- Abdominal or stomach discomfort
- Cough or hoarseness
- Decreased appetite
- Diarrhea
- Fast or shallow breathing
- Fever or chills

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- General feeling of discomfort
- Lower back or side pain
- Muscle pain or cramping
- Painful or difficult urination
- Sleepiness

Another way to manage, or should I say REVERSE insulin resistance, is by correcting the problem without drugs! The benefits of nutritional supplementation are so numerous, including restoring insulin sensitivity, and reversing insulin resistance and type 2 diabetes, as well as reduction in heart disease, stroke, dementia, arthritis, skin aging, etc. Nutritional supplements also help fertility, support for mood, cognition, memory, and normal hormone production and synchronization. Since supplements support the normal release of FSH and LH, let alone all the other hormones in the brain (dopamine, serotonin, melatonin, growth hormone, DHEA, and more, it only makes sense to use properly-balanced nutritional supplements to reverse PCOS. **My protocol starts with** a broad spectrum, potent and pure foundation of micronutrients; that is, multiple vitamins, antioxidants, and chelated minerals, all of which I consider to be **the essentials**. Included in this foundation are trace minerals, selenium, chromium, and zinc, which are all important in many enzymatic functions, including insulin tolerance and glucose metabolism and endogenous cellular antioxidant enzymatic reactions. Although there are no studies published with the use of these multiple supplements (a vitamin and mineral “cocktail,” if you will), in the ratios and amounts I have suggested to reverse PCOS, but there are scientific published studies to support the benefits of single or combination of a couple micronutrients together in the treatment of PCOS, including vitamin D, calcium, magnesium, selenium, chromium, zinc, and fish oil (omega 3 fatty acids).<sup>18 - 25</sup>

Researchers do not study multiple nutrients, and how they can affect everything simultaneously. They want to show how a single item, whether it is a drug or micronutrient, can affect a particular outcome. However, nutritional supplements are not meant to act independently like a drug. Micronutrients are meant to act synergistically, and in a very complex manner, to affect multiple cellular pathways to produce the desired outcome. To my knowledge, no researcher has taken on that particular double-blind, placebo-controlled clinical trial.

I think of trying to study the outcome of a single chemical compound, whether natural or synthetic, to be like trying to figure out what makes a plane fly, and study one set of wings, or one set of tail wings, one fore or aft wing elevators, or the propeller, all separately to see what provides the final result of controlled air flight. None of these individual aspects in and of themselves result in perfect controlled flight; it is only the combination, and synchronization of all components together that results in the desired result. But, we have researchers essentially focused on studying the results of one aspect; one micronutrient, not the entire broad spectrum in proper ratios and amounts with other micronutrients.

In the real world, and in my practice, I saw the results of what happens when micronutrients are supplied to the body in proper ratios, balance, amounts, and purity. The evidence I have from my own experience with hundreds of patients with PCOS over 21 years, and hundreds of others from around the world, with essentially 100% success, gives me the confidence to know that this protocol absolutely works.

I only recommend a **pure fish oil** that I know is free of PCBs, and organic residues (dioxins), which get into the brain and cause dysfunction, let alone other hormonal problems. Consumer

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Labs.com is an independent organization that sends out dietary supplements for testing to see if the products have the ingredients, and in the amounts listed on the label, as well as if the products are free of contaminants, like lead or other substances. This organization sent out 35 commonly used fish oil brands for testing. Nearly a third (31%) of the brands were found to have problems, including contamination with PCBs.<sup>26</sup> The omega-3 fats (fish oil) brand I recommended was not found to have PCBs, organic residues, and provides generous doses of both EPA and DHA. I know the quality control, and have visited the FDA-registered manufacturing facility, and know of the pharmaceutical standards of manufacturing that are followed to ensure potency and purity.

**Omega-3 fatty acids (in the fish oil)** are critical for normalization of brain and hormone functions. The hypothalamus functions properly to release GnRH, FSH, and LH to eliminate the cause of PCOS. Omega-3 fatty acids have also been shown to reduce mood swings, depression, PMS, and other brain disorders. The hypothalamus is responsible for producing dopamine. It also stimulates the pituitary to produce serotonin and growth hormone. Fish oil helps support the neurons, neurotransmitters, and hormones allowing for proper functioning. In addition, fish oil helps reduce the risk of cardiovascular disease, diabetes, arthritis, chronic inflammation throughout the body, and of course, reduce the development and progression of breast cancer.<sup>27</sup>

**Calcium and magnesium** are important minerals for the functioning of neurons, neurotransmitters, muscles, and metabolism. There are studies that show that calcium, in combination with vitamins K and D has beneficial effects on androgenic hormones (testosterone, DHEA-S, etc.) in women with PCOS.<sup>28</sup> There are many benefits for these minerals, including insulin function, glucose metabolism, weight control, energy, blood pressure control, etc. These two minerals should be taken in correct ratios, and from a brand that provides a form that is dissolvable, absorbable, and bio-available.

In addition to the 2000 IU of **vitamin D3** in the essential foundation of basic supplements and fish oil combined, I also recommend an additional 4000 IU of vitamin D3, or **a total of roughly 6000 IU/day**.<sup>29, 30</sup> My goal is to attain a vitamin D level, known as 25(OH)D of 60 – 80 ng/ml (which is the same as 150 - 200 nmol/l). This is not only a safe level of vitamin D3, it is the level associated with the reduction in nearly every chronic disease! Everyone absorbs vitamin D in different amounts, and probiotics assist with absorption. As a side benefit, probiotics assist with neurotransmitters, immune support, and skin health.

To accelerate insulin receptor antioxidant protection and eliminate insulin resistance, and restore insulin sensitivity, which controls blood sugar levels and improves metabolism, as well as controls weight gain, I suggest a **pure grape seed extract**, which is an antioxidant that works everywhere in the body, including in the brain, as it crosses the blood-brain barrier.

**Grape seed extract** protects neurons, proteins, receptors, hormones, cell membranes, DNA, and lipids (fats) from free radical damage. It works as an inhibitor to the Cox 2 enzyme to reduce excessive inflammation. Since chronic low-grade inflammation is like slow-cooking the inside of the arteries, as well as other tissues, such as the joints, brain, and all other tissues, being able to employ a powerful non-toxic anti-inflammatory and antioxidant is especially important. Grape seed extract reduces both oxidative stress and inflammation.





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Since protection against oxidative stress and inflammation is so important and effective, I usually recommend a double or triple dose of the pure and potent grape seed extract. I only recommend a brand that ensures pure, high-potency, and bio-available grape seed extract, which has over 90% of the active antioxidant ingredient. Most brands, especially purchased over-the-counter, do not provide the active ingredients, proanthocyanidins and monomers at that potent level.

Most brands provide the active ingredient (proanthocyanidins) at less than 20% of the total ingredients; and without any monomers. It makes you wonder what these manufactures think grape seed extract is. Milligram for milligram, with the brand I recommend not only provides the best value, as you get more active ingredient for the money, it is what actually works! And, in the end, using a quality brand that causes these life-changing improvements in health is the whole reason to take the supplements in the first place. It makes no sense to spend money on cheap, low-quality supplements that do not provide noticeable health improvements. Most people don't know that what is written on the label is often not in the product, and that the ingredients are not to proper potency, purity, and bio-availability. Most people just want cheap.

However, people suffering from chronic problems, like PCOS want health. They want improvements in their situation. And, people want to know that what they are doing will also make a difference in their lifelong health. In the end, getting a true value is more important than buying something cheap.

Pure and potent **grape seed extract**, particularly paired with the enhancing ingredient in the brand I recommend, provides benefits to support health and normal functioning of the brain, heart, liver, arteries, lungs, kidneys, bladder, (prostate in men), breasts, cervix, ovaries, intestines, eyes, joints, and skin. The metabolic factors are supported, as insulin receptors and the cells are protected from oxidative stress, allowing the cell to produce normal insulin receptors that function properly, as well as protects against oxidation of skin oil (sebum), thereby **reducing acne development**.

As an option, if the patient wants even faster, and more complete protection and health improvements from PCOS and beyond, I recommend a product that is marketed for "liver support," but it actually provides so many micronutrients, including **green tea extract, N-acetyl-L-cysteine (NAC), turmeric extract**, alpha lipoic acid, and more, which are helpful for insulin function and glucose normalization, as well as cardiovascular health, brain health, liver health, immune support, and acceleration of skin improvements, and resolution of PCOS.<sup>31, 32</sup>

Do you need to stay on the supplements to keep PCOS under control? Yes, and thank goodness you do, as the long term benefits of quality nutritional supplements include lifelong health and reduced risk of nearly every chronic disease. Why wouldn't anyone want to be on quality supplements for that kind of benefit whether they had PCOS or not? That is why I make these nutritional supplements a part of my daily life.

Proper nutritional supplementation is also important for preparing for pregnancy, as well as during pregnancy for development of the baby's brain and other organs, and reducing the risk of most pregnancy complications, including pregnancy-induced hypertension, gestational diabetes, preterm labor, and more.



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There is no downside, and nothing but benefits for proper nutritional supplementation. True lifelong health is what I call the power of cellular nutrition.

### Conclusion:

Polycystic Ovarian Syndrome is a disease experienced by so many women of reproductive age, with its accompanying distressing weight gain, acne, unwanted facial hair growth, and absence of normal menstruation. It is also a cause of infertility because ovulation is absent or irregular. The traditional medical treatment only manages the symptoms, but does not address the underlying true cause of PCOS, nor does it reverse the disease entirely. Only proper nutritional supplementation, which is unknown to most doctors and patients, is the perfect way to reverse PCOS, insulin resistance, acne, hirsutism, and restore a woman's health back to normalcy, while providing her overall better health, better mood, and energy.

I have seen the below protocol work for over 20 years. It never fails if followed regularly. It is not "an alternative approach," it is the logical, most effective, and best approach to PCOS.

### Supplementation Protocol for Reversing PCOS and Related-Health Concerns:

Below is a broad spectrum supplement protocol that I have seen work for my patients. A woman with a mild case, may only need the first 5 items on the list; and a more severe case may need all the items listed. All will benefit from all items listed, with relatively quick results. None of the supplements (or brand) that I recommend interferes with most medications, and none that are used in the treatment of PCOS. (Most of my patients found that they did not require medications once the results were evident within a few months.) None of what I recommend (and particularly the brand I use) is at toxic or harmful at the levels I suggest. Again, clear this with your doctor. *Please see medical disclaimer.*

I do not state the name of the brand that I use and recommend in this article for specific reasons, but here is the list of what types of supplements that make up my protocol (please contact me for suggestions on a quality brand).

Supplement	AM	Noon	PM
Vitamin-Antioxidant Tablet*	2		2
Chelated Minerals Tablet*	2		2
Fish Oil (Omega 3) Capsule	3		3
Magnesium-Calcium-Vitamin D Tablet	2		2
Grape Seed Extract with Vitamin C, 100 mg	2		2
Vitamin D3 (2000 IU per tablet) Tablet	1		1
Saw Palmetto-Lycopene Capsule*	1		
Liver Health Complex Supplement Tablet*	2		1
Co-Enzyme Q10 with Alpha Lipoic Acid, 30 mg	2		2
Probiotics Powder Dose Pack* (every other day)	1		

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AM: With, or after breakfast; Noon: At lunchtime with food, or shortly thereafter; PM: Late afternoon with food, or at, or after dinner

\*Please see my list of ingredients (at the end of this article) that I like to see in a foundational vitamin and mineral supplement product.

\*Saw Palmetto with additional nutrients, 1 – 2 capsules per day, if acne and excess facial hair.

\*Liver health supplement, 1 – 2 tablets, twice daily

This provides many ingredients, including N-Acetyl-L-Cysteine (NAC), turmeric extract (curcumin), green tea extract, olive extract, broccoli extract, alpha lipoic acid, milk thistle extract, and biotin.

\*Probiotics, at least take 12 billion colony-forming bacteria, providing Lactobacillus rhamnosus LGG® and Bifidobacterium BB12®, every other day or daily.

*Medical disclaimer: I preface any dietary supplement regimen, especially in light of what was discussed above, as not being medical advice. I do not give medical advice, as that is between a patient and her doctor. I suggest that you talk to your doctor about any supplement program prior to starting, as this supplement protocol is intended to be taken to your doctor to be used a discussion as to what is right for you. Do not discontinue any medications without proper medical consultation with your personal health care provider.*

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**Ingredients, and daily total, that I like to see provided collectively by vitamin-antioxidant & chelated mineral tablets:**

Vitamin A, mostly as beta carotene 12,000 IU (beta carotene is not associated with birth defects or liver concerns)

Vitamin C 1000 mg

Vitamin D3 2000 IU (and an additional 2000 – 4000 IU supplied by a stand-alone Vitamin D3 product)

Vitamin E 300 – 400 IU (of mix of D-alpha tocopherol, D-gamma tocopherol, D-beta & D-delta tocopherols)

Vitamin K (K1 & K2) about 500 – 550 mcg

B-Complex Vitamins various doses, with at least 600 mcg of folic acid, or methyl folate (500 mcg of methyl folate can be added)

Curcumin (turmeric extract) 70 mg in these tablets, and an additional 45 mg from a liver support product

Quercetin 60 mg

Green Tea Extract 70 mg from these tablets, and an additional 45 mg from a liver support product

Olive Extract 30 mg from these tablets, and an additional 45 mg from a liver support product

Rutin 40 mg

Resveratrol 40 mg

Choline 250 mg

Lutein 600 mcg

Lycopene 1000 mcg

N-Acetyl-L-Cysteine (NAC) 160 mg

Calcium at least 200 mg (and an additional 800 mg supplied by a separate magnesium-calcium tablet)

Magnesium at least 200 mg (and an additional 200 mg supplied by a separate magnesium-calcium tablet)

Iodine (as potassium iodide) 500 mcg

Zinc 20 mg

Selenium 200 mcg

Copper 2 mg

Manganese 2 mg

Chromium 300 mcg

Molybdenum 50 mcg

Boron 3000 mcg

Silicon 4 mg

Vanadium 40 mcg

Including Ultra Trace Minerals around 3000 mcg

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