

## MINERALS AND THE PROSTATE GLAND

The prostate gland is often described as a chestnut shaped organ that surrounds the beginning of the urethra in the male. It is responsible for the manufacturing and secretion of a milk fluid that is discharged by excretory ducts into the prostatic urethra at the time of semen emission. Figure 1 depicts the basic anatomy of the male prostate.

The development of BPH is an almost universal phenomenon in the aging male world wide. The most commonly occurring disorders of the prostate include prostatitis, benign prostatic hyperplasia (BPH), and prostatic carcinoma. Prostatic carcinoma is the third most common cause of death in males over the age of 55, while in the USA and most other developed countries, prostate carcinoma is the second most common cause of cancer mortality<sup>1</sup>. Beginning at about age 70, mean plasma testosterone values decrease. There is also an associated rise in plasma LH and an increase in the rate of conversion of androgen to estrogen, so that the effective ratio of androgen to estrogen is significantly decreased. This background of endocrine changes in the aging male may provide part of the trigger initiating prostate diseases. The prostate weighs only

about a few grams at birth. At puberty, it undergoes an androgen induced growth spurt, reaching its adult weight of 20 grams by age 20. It basically stays the same for the next 25 years, when it undergoes another growth spurt in the majority of males.

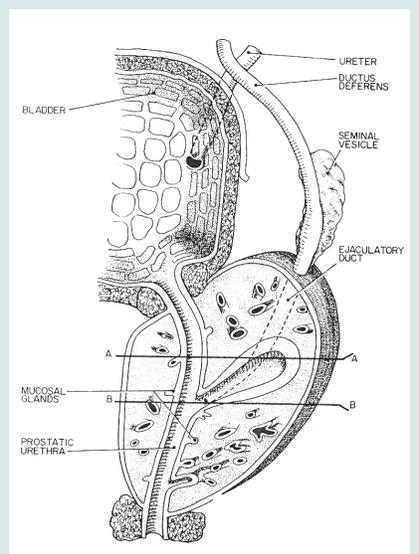
It has been shown that there is about a five-fold increase in the level of Dihydrotestosterone in men with BPH. It is well known that Dihydrotestosterone (DHT) can make the prostate enlarge. Most of this enlargement takes place in the periurethral region of the gland, which

differentiates the second growth spurt of the prostate from the one that occurs at puberty. In addition, estradiol acts synergistically with DHT to stimulate prostate growth. In view of the fact that estradiol production increases in the aging male, and DHT levels are increased in BPH, the endocrine changes of aging are obviously thought to be involved in the etiology of the various prostate diseases.

Typically, diseases of the prostate will cause some bladder outlet obstruction, resulting in urinary frequency, as a result of incomplete emptying and rapid refilling of the bladder. A quick view of the anatomy of the prostate (Figure 1) can show you that this is an obvious outcome of any disease that causes prostate enlargement.

Many efforts have been made to study associations between nutrition and prostate health. There seems to be a strong relationship between total fat intake and prostate cancer<sup>1</sup>. Evidence is accumulating in the area of the possible roles of certain micronutrients in the protection of prostate health.

Figure 1



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**Zinc and cadmium**

## analysis in human prostate cancer

*Biol Trace Elem Res 1997 Winter;59(1-3):145-52 Brys M, et al*

This study was tested the hypothesis that prostatic cancer is associated with the changes of zinc and cadmium tissue concentrations. Men with normal prostate, benign prostatic hyperplasia (BPH) and prostatic carcinoma (PCA) were analyzed for zinc and cadmium by atomic absorption spectrometry. Cadmium level was measured using graphite furnace and the zinc level by flame mode. Metal content was assessed in whole tissues and in nuclear, plasma membrane, and cytosolic fractions. An increase of zinc content in BPH, but a decrease in PCA as compared to normal tissue, was observed. Cadmium concentration appeared to be higher in BPH and PCA than in normal tissue. No correlation between zinc and cadmium level was found in BPH specimens obtained from the same patients. Results suggested that cadmium increase may contribute to carcinogenicity and prevent the functioning of zinc in prostatic cancer. Plasma membrane fraction corresponding to lysosomal, mitochondrial, and microsomal subcellular compartments are probably critical in zinc and cadmium participation in human prostate neoplasms.

**Zinc in the human prostate gland: normal, hyperplastic, and cancerous**

*Int Urol Nephrol 1997;29(5):565-74 Zaichick VYe, et al*

Zinc concentration in a prostate gland is much higher than in other human tissues. Data showing zinc changes in different prostate diseases are limited and frequently contradictory. To analyze transrectal puncture tissue biopsy and resected materials, zinc content was estimated in benign prostatic hyperplasia (BPH) and in prostate cancer. There were 109 patients studied (50 BPH and 59 cancer). The control group consisted of 37 intact glands of men who had died unexpectedly. All materials studied were divided into two parts. One of them was morphologically examined, while the zinc content of another one was estimated. The radionuclide induced energy dispersive X-ray fluorescent analysis was used for zinc determination. Zinc content of normal prostate, BPH, and cancer was 1018 +/- 124, 1142 +/- 77, and 146 +/- 10 micrograms/gram dry tissue, respectively. It was shown that zinc assessment in the material of transrectal puncture biopsy of prostate indurated site can be used as an additional test for differential diagnosis of BPH and cancer. Accuracy, sensitivity and specificity of the test are 98 +/- 2%.

**Zinc and magnesium serum levels in patients with benign prostatic hyperplasia (BPH) before and after prazosin therapy**

*Mater Med Pol 1995 Jan-Mar;27(1):15-17*

*Dutkiewicz S*

In 32 patients with benign prostatic hyperplasia (BPH) serum levels of zinc and magnesium were studied before and after prazosin therapy at 4mg per day. Following cessation of the therapy a slight increase in zinc levels was observed (from 99.79 to 103.29 mcg/dl). Magnesium levels did not change to any real degree. In comparison with other organs, the human prostate is characterized by high zinc and magnesium content. In BPH, the zinc levels are increased. They are markedly decreased in carcinoma of the prostate and in prostatitis. Zinc and magnesium play an important role as catalysts in various enzymatic reactions. It has been postulated that changes in concentrations of these two elements are parallel. Kvist has found that zinc imparts resistance to detergent-induced decondensation of spermatozoan nuclear chromatin. The effect was more pronounced with higher zinc concentrations in a buffer fluid. Other bivalent cations were found ineffective in stabilizing nuclear chromatin under such conditions. A possible role for seminal zinc in prevention of the reduction of disulfide cross-links and nuclear decondensation was postulated. Zinc also plays an important role in protein synthesis. Zinc ions inhibit androgen metabolism in the prostate. Physiologic zinc serum levels are equal to or above 90 micrograms/dl. Magnesium, unlike zinc, is uniformly distributed within different areas of the gland. IN BPH, both normal and increased magnesium levels in the prostate have been reported. Magnesium plays a key role as an activator of phosphatases involved in

ATP metabolism, thus affecting both catabolic and anabolic processes.

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## **Zinc arginine, 5 alpha-reductase inhibitor, reduces rat ventral prostate weight and DNA without affecting testicular function**

*Andrologia, 1993 Nov-Dec; 25 (6):*

369-375

*Fahim MS, et al.*

Zinc has been implicated in the steroid endocrinology of the prostate gland; and 5 alpha-dihydrotestosterone (DHT) is believed to express androgenic responses in the prostate. To note the effect of neutralized zinc (zinc gluconate plus arginine) on the prostate, 50 sexually mature rats, weighing 325 +/- 20 g, were divided into five groups as follows: (1) control, (2) sham, (3) castrated, and injected intraprostatically with (4) 10 mg neutralized zinc, and (5) 20 mg neutralized zinc.

Results indicated significant reduction ( $P < 0.05$ ) of prostate weight, 5 alpha-reductase activity, and total protein and DNA concentrations in treated prostate tissue; no significant change in weight and histological structure of testes, epididymis, and seminal vesicles; and no significant effect on progeny and blood testosterone level of treated animals. These results suggest that direct application of neutralized zinc to the prostate offers a new modality for treatment of prostatitis without affecting spermatogenesis.

## **Decreased incidence of prostate cancer with selenium supplementation: results of a double blind cancer prevention trial**

*Br J Urol 1998 May; 81(5):730-734*

*Clark LC, et al.*

The study was conducted to assess the impact of supplemental selenium on the incidence of prostate cancer. A total of 974 men with a history of either a basal cell or squamous cell carcinoma were randomized to either a daily supplement of 200 mcg of selenium or placebo. Patients were treated for a mean of 4.5 years and followed for a mean of 6.5 years. The selenium treated group was found to have a significant (63%) reduction in the secondary endpoint of prostate cancer incidence during the period of 1983-1993. There were 13 prostate cancer cases in the selenium-treated group, and 35 cases in the placebo group. When the analysis was restricted to the 843 patients who had prostate-specific antigen (PSA) levels that were  $\leq 4$  ng/mL, it was found that only 4 cases were diagnosed for the selenium-treated group and 16 found in the placebo group, after a 2 year lag. Conclusion: Although selenium shows no effect on the initial skin cancer condition, it had substantial reductions on the incidence of prostate cancer, as well as total cancer incidence and mortality. The selenium treated group showed significant health benefits for other secondary endpoints, such as total cancer mortality, and incidence of total, lung, and colorectal cancer.

## **Zinc Inhibits Prostate Cancer** **The American Society for Cell Biology**

*41st Annual Meeting, Dec. 8-12, 2001*

*Washington, DC Pei Feng*

Prostatic cancer is the second leading cause of cancer death in American men. Prostatic cancer remains somewhat mysterious at the cellular level. Zinc is most assuredly part of this mystery. A normal prostate gland contains 3-10 times more zinc than any other body tissue. However, the zinc level in the cancerous prostate is very low. Apparently, malignant prostate cells lose their ability to accumulate zinc, but how this affects the development of cancer has been uncertain. A recent study (Feng F, et al, Effect of zinc on mitochondrial apoptosis in human prostate, publication pending) at the University of Maryland Dental School and the Greenbaum Cancer Center reports that high levels of zinc act as a brake on runaway prostate cell growth by increasing apoptosis (programmed cell death). Cells with defective DNA may activate the cell death pathway and destroy themselves. When normal prostate epithelial cells are exposed to zinc, they accumulate high levels of zinc and their growth is controlled. When malignant prostate cells become unable to accumulate zinc, they begin to multiply uncontrollably. According to the researcher's recent work, zinc maintains the balance between cell proliferation versus cell death by reacting against the mitochondria. Treatment to increase zinc sharply

increased apoptosis in the malignant and hyperplastic cells. The zinc treatment triggered apoptosis by forcing the mitochondria to release a chemical called cytochrome c, which in turn activated the destructive enzymes called caspases. Caspases are the executioners of cell death. Normal prostatic cells were oblivious to increased zinc levels. If zinc accumulation can block apoptosis in prostate cells, restoring the ability to retain zinc in malignant cells could halt the spread or even stop prostate cancer cells from getting started.

## Summary

Zinc has been reported to interfere with the conversion of testosterone to DHT, thereby, preventing prostate enlargement (Leak, et al, [J Steroid Biochem 198420:651-665]) and Fahim and Sutcu [Andrologia, 1993 Nov-Dec;25(6): 369-375] found that zinc therapy can reduce the size of the prostate. From the available research to date, it appears that zinc, selenium, and magnesium are minerals that play a definite role in the maintenance of a healthy prostate gland. Zinc and magnesium exert some of their effects here

on the regulation of androgens, such as testosterone. Additionally, selenium and zinc have roles related to apoptosis rates in normal and cancerous cells. In Albion's Research Notes volume 9, Number 1 (March 2000), the following abstract of a study on Albion's zinc and the male gonadal tissue was documented:

## ZINC ARGININE AMINO ACID CHELATE

*Study by: Dr. D. Graff  
Weaver State University, Aug 1985*

The objective of the following experiment was to determine the targeting of various amino acid chelates into the male reproductive organs, since the literature points out that 80% of seminal fluid is composed of arginine. Further, that arginine has been found useful in cases of sterility. Therefore, if arginine is indeed a significant component of seminal fluid, it should be the amino acid of choice to carry a mineral cation into the seminal fluid or testes.

Eighteen rats weighing 200 grams +/- 10 grams were divided into three groups of 6 animals each. [0.06

moles of arginine and 0.06 moles of glycine respectively were chelated with 1.0 mole <sup>65</sup>zinc from zinc chloride and an additional 1.0 mole of <sup>65</sup>zinc chloride was used as a control]. Next 10 microliters of each chelate and the inorganic zinc were injected into the respective group of 6 rats each.

After 24 hours, the animals were tested. The following male reproductive organs: testes, epididymis and seminal vesicles were examined for radio active metal isotopes. The ligand was not tagged or measured in this experiment, since the ligand purpose in this experiment was to service as a carrier.

In all animals, the rate of assimilation followed the ranking in favor of the zinc arginine chelate. The seminal vesicles and contents generally contained more activity than either the testes or epididymis. This experiment parallels literature reports in which the targeting of arginine to the seminal fluid and testes is reported.

NOTE: As it can clearly be seen, both chelates of zinc-glycine and arginine penetrated the male reproduction area at a rate greater than the zinc

Figure 2

cc pm/mg tissue 24 hours post treatment

Tissue	<sup>65</sup> Zinc Glycine	<sup>65</sup> Zinc Arginine	<sup>65</sup> Zinc Chloride
Testes	0.96	1.26	Negligible
Epididymis	0.73	1.03	Negligible
Seminal Vesicle	1.98	2.53	Negligible

salt form. In this study, it is clear that the Zinc Arginine Chelate is the real “Chelazone®”, since it had an even greater male gonadal penetration capacity than the zinc glycine chelate. It penetrated the male gonadal tissue at rates that were 27-41% greater than the standard chelate.

The findings by Dr. Graff concerning Albion’s Zinc Arginine Chelate tend to support the work of Fahim MS, et al [Andrologia, 1993 Nov-Dec;25(6): 369-375], which showed the benefits to the addition of arginine to a zinc gluconate supplement for treating prostatitis. In the instance of Albion’s Zinc Arginine Chelate, the arginine

is already in the actual ingredient and Dr. Graf clearly showed that this had male gonadal tissue penetrating advantages.

Albion offers highly bioavailable forms of magnesium and selenium, as well. Both of these minerals have been seen to be of value to the health of the male prostate. When formulating a product for prostate support, look to the following Albion mineral ingredients:

- Zinc Arginine Amino Acid Chelate
- Selenium Amino Acid Complex
- Magnesium Chelazome®

- Magnesium Buffered Amino Acid Chelate
- Zinc Chelazome®
- Zinc Histidine Amino Acid Chelate

Only Albion offers the finest 100% reacted mineral amino acid chelates and complexes. Kosher-Parvé certified. Clinically proven. Quality assured. Patent protected.

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## References:

1. *Diet, micronutrients, and the prostate gland*, JA Thomas, *Nutr Rev*, Vol 57 No. 4, pp95-103.

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