

# Biochemical changes in some trace elements, antioxidant vitamins and their therapeutic importance in prostate cancer patients

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## ABSTRACT

**Aim:** This study was conducted to evaluate the serum levels of some trace-elements (zinc, copper and selenium) and antioxidant vitamins (vitamin A, C and E) in prostate cancer patients.

**Method:** A total of 50 prostate cancer patients aged 50-70 years with PSA > 4.0 ng/dl were recruited for the study while 50 apparently healthy individual were used as control subjects. Zinc, copper and selenium were determined using atomic absorption spectrophotometer while vitamin A, C and E were determined using high performance liquid chromatography.

**Result:** The result showed that the mean levels of Se ( $0.77 \pm 0.26$ ), Zn ( $147.75 \pm 42.05$ ) were significantly lower ( $p < 0.05$ ) when compared with the control ( $1.47 \pm 0.13$ ) and ( $168.78 \pm 59.80$ ) respectively. The serum copper level ( $187.76 \pm 66.05$ ) was significantly higher ( $p < 0.05$ ) when compared with control ( $126.40 \pm 31.24$ ). The antioxidant vitamin A ( $0.42 \pm 0.19$ ), vitamin C ( $3.62 \pm 1.81$ ) and vitamin E ( $0.39 \pm 0.13$ ) were Significantly lower ( $p < 0.05$ ) when compared with the control ( $0.68 \pm 0.32$ ) ( $12.16 \pm 4.07$ ) and ( $1.40 \pm 0.16$ ) respectively. **Conclusion:** The decreased trace elements and antioxidant vitamins may be associated with high free radicals generated due to oxidative stress in prostate cancer patient.

**Key words:** Prostate cancer, Trace elements, Antioxidant vitamins and Biochemical changes

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## INTRODUCTION

Cancer is a disease caused by an uncontrolled proliferations of abnormal cells in any part of the body forming a tumor. Tumor can be benign or cancerous. Cancer is named according to the organ it affects. Prostate cancer is actually a tumor located in the prostate.<sup>1</sup>

Prostate cancer is the second most common cause of tumor related deaths in the western world.<sup>2</sup> Prostate cancer is the topmost killer among Nigerian men and constitutes 11% of all male cancers.<sup>3</sup> Prostate cancer is very heterogeneous in its etiology and progression but androgen signalling appears to be common key element in its development and cellular progression.<sup>4</sup>

Prostate-specific antigen (PSA), digital rectal examination and prostate biopsy used to be earliest diagnostic tools for prostate cancer but have been complemented by the use of PSA velocity.<sup>5</sup> A man's risk of developing prostate cancer can be associated with age, genetics, race, diet, lifestyle, medication and other factors. However, the specific cause of prostate cancer remains unknown.<sup>1</sup>

In Nigeria, 2% of men develop prostate cancer and 64% of them die after 2 years.<sup>6</sup> Evaluation of biochemical changes in some trace elements; zinc, selenium, copper and antioxidant vitamins; vitamin A, C and E may be of epidemiological importance in the early diagnosis, prognosis, and therapy evaluation of prostate cancer patients. Through the assessment of these trace elements and antioxidant vitamins,

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some adverse clinical states and complications that may lead to death as a result of deficiency or excess of these biochemical parameters in prostate cancer patients may be prevented. Hence, the need to embark on this study.

## MATERIALS AND METHODS

Venous blood was collected from 50 prostate patients with PSA > 4 ng/ml and also from 50 apparently healthy male subjects that served as control group. Serum was analysed for zinc, copper and selenium using atomic absorption spectrophotometer while vitamin A, C and E using high performance liquid chromatography.

### Statistical analysis

The version 16 of SPSS package was used in statistical analysis. The results were expressed as mean SD. Comparison were made using student's T-test and  $P < 0.05$  was regarded as significant.

Routine assessment may help in early diagnosis and supplements may be beneficial in the prevention and treatment of prostate cancer.

## RESULTS

The mean levels of selenium ( $0.77 \pm 0.26$ ) and Zinc ( $147.75 \pm 42.05$ ) were significantly lower ( $p < 0.05$ ) when compared with the control ( $1.47 \pm 0.13$ ) and ( $168.78 \pm 59.80$ ) respectively. Copper serum level ( $187.76 \pm 66.05$ ) was significantly higher when compared with the control ( $126.40 \pm 31.24$ ) (Table 1).

In prostate cancer patients, the mean levels of vitamin A ( $0.42 \pm 0.19$ ) were significantly lower ( $p < 0.05$ ) when compared with the control group ( $0.68 \pm 0.32$ ). The mean level of vitamin C ( $3.62 \pm 7.81$ ) and vitamin E ( $0.39 \pm 0.13$ ) in prostate cancer patients were significantly lower ( $p < 0.05$ ) when compared with the control group ( $12.16 \pm 4.07$ ) and ( $1.40 \pm 0.16$ ) respectively (Table 2).

## DISCUSSION

This study shows that there are biochemical changes in the serum level of some trace elements and antioxidant vitamins in prostate cancer patients when compared with the control. Lower levels of selenium were observed in prostate cancer patients. This corroborated with other findings that selenium level was significantly lower when compared with the control subject.<sup>7,8</sup>

Selenium has been hypothesized to play a role in preventing cancer.<sup>9</sup> The decrease in selenium level may be related to

**Table 1: Serum levels of some trace elements in prostate cancer patients and male control subjects**

Group	Se ( $\mu\text{mol/L}$ )	Zn ( $\mu\text{g/dL}$ )	Cu ( $\mu\text{g/dL}$ )
Male control	$1.47 \pm 0.13$	$168.78 \pm 59.80$	$126.40 \pm 31.24$
Prostate cancer	$0.770.26^*$	$147.75 \pm 42.05^*$	$187.76 \pm 66.05^*$

\*Significantly different from control at  $p < 0.05$

**Table 2: Serum levels of antioxidant vitamins in prostate cancer patients and male control subjects**

Groups	Vitamin A (mg/L)	Vitamin C (mg/dL)	Vitamin E (mg/dL)
Male control	$0.68 \pm 0.32$	$12.16 \pm 4.07$	$1.40 \pm 0.16$
Prostate cancer	$0.42 \pm 0.19^*$	$3.62 \pm 1.81^*$	$0.39 \pm 0.13^*$

\*Significantly different from control at  $p < 0.05$

the action of selenium in fighting the abnormal growth as well as the impact of the disease on the patients. Selenium plays a role in cell cycle arrest, decreasing cell proliferation, inducing apoptosis, facilitating DNA repair by activation of p 53, disruption of androgen receptor signalling and being a key component of selenoenzymes.<sup>10,11</sup> The low levels of selenium in these patients may hinder the essential functions of this element in prostate cancer patients.

Serum levels of zinc were significantly lower in prostate cancer patient when compared with the control group. The decrease in zinc level observed from the study corroborated with the findings of other researchers.<sup>8,12</sup> This may be related to the loss of the ability of prostate cancer cell to amass zinc in prostate cancer patient since total zinc level in the prostate are ten times higher than those in other soft tissues.<sup>13</sup> Zinc is an essential trace element required for normal functions of several enzyme systems such as dehydrogenases, phosphates,  $5\alpha$ -reductases, carboxypeptidases and carbonic anhydrase. In prostate cancer patients, the essential roles of zinc may be compromised.

Copper serum level were increased in prostate cancer patients as shown from the result of the study. This findings agrees with other researcher.<sup>14</sup>

Cupric ions are reported to inhibit the production of singlet oxygen; this is of particular physiologic significance because of the latter's ability to cross cell membrane and its high activity towards various biomolecules. Increased level of copper in serum of prostate cancer patients may be due to the release of cytosolic and nuclear copper into the extra cellular compartment.

Vitamin A, C and E are the antioxidant vitamins that were studied. From the result, vitamin A, C and E were significantly lower in prostate cancer patients when

compared with the control subjects. This agrees with the work done by other researchers.<sup>15,16</sup> Decrease in vitamin A, C and E could be as a result of inadequate dietary intake of fruits containing these antioxidant vitamins. It may also be related to the possibility that vitamin C and E reacts very rapidly with molecular oxygen and free radicals generated during prostate carcinogenesis.

Vitamin A, C and E are important antioxidants that protect the cells and tissue from harmful substances and free radicals. They also strengthen the immune system and fight cancerous cells. Lower levels of these antioxidant vitamins expose the prostate cancer patients to infections and the destructive effect of the free radicals released in the body.

## CONCLUSION

From the above study, some of the trace elements and antioxidant vitamins were decreased in prostate cancer patients. Assessment of these trace elements and antioxidant vitamins may be useful in early diagnosis, prognosis and therapy evaluation of prostate cancer patients. Zinc, selenium, vitamin A, C and E supplementation may be recommended in the management of prostate cancer patients. Adequate intake of vitamin C may also help to reduce the risk of infection in these patients.

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### Authors Contribution:

**OBO** – Conceived and designed the study, made the first draft of the manuscript; **MSC** – Concept and design of the study; **IE** – Analysis and interpretation of data, manuscript preparation; **NJ** – Data collection, literature searches, manuscript review; **OO** – Data collection and literature searches.; **MMB** – Literature searches and manuscript preparation. All authors reviewed and approved of the final manuscript.

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