Association of Body Mass Index with Serum Vitamin D and PSA Levels among Sudanese Prostate Cancer Patients

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Abstract

Background: Prostate cancer is the second most common cancer in men worldwide and the second leading cause of cancer deaths in men in the United States. Obesity has been consistently associated with lower 25-hydroxyvitamin D (25(OH)D) concentrations.

Objectives: This cross-sectional study aimed to evaluate the serum vitamin D and PSA levels in Sudanese Obese and Non-Obese prostate cancer (PCa) attending the National Cancer Institute.

Patients and Methods: Eighty six prostate cancer patients were included in this study, they were identified by clinical examination, histopathology and prostate-specific antigen (PSA). The mean age of them was 71.78 ± 8.04 years. Serum Vitamin D and PSA were measured by Electrochemiluminescence (ECL) immunoassay reactions using (Cobase411, serial No: 0868-16, manufactured by Hitachi high technologies corporation, Tokyo-Japan) the Elecsys reagents kit (Roche – Germany)

Results: The means of serum vitamin D levels of among obese was 35.5 ± 15.4 ng/dL and 38.4 ± 16.2 ng/dL among non-obese group with non-significant differences (P=0.505). No significant association was observed between PSA levels and obese and non-obese (P=0.351). Vitamin D levels non-significantly negative correlated with BMI (r = -0.031, P = 0.778) and PSA (r = -0.062, P = 0.569), but there was insignificantly positive correlated between PSA and vitamin D level (r = 0.151, P = 0.164).

Conclusion: insignificant differences between vitamin D and serum PSA with BMI, Oral supplementation is recommended for individuals with low level of vitamin D.

Keywords: Prostate cancer, Body mass index, Vitamin D, PSA, Sudanese.

Introduction

Prostate cancer (PCa) is one of the most common type of cancer among men in the Unite State of America, and African American (AA) men have higher prevalence and mortality rates compared to European American (EA) men and different racial/ethnic corporations. Sudan changed into the largest country in Africa until 2011, when South Sudan separated into an imperial country. The prevalence of prostate cancer within the Sudan becomes the most common type among the Sudanese men based on GLOBOCAN 2018 estimating prostate cancer to 9.2% among adult males, all ages.
one take a look at has determined that BMI could influence PSA tiers. Seo et al. were given the same end: with the BMI increasing, the PSA tiers reduced.

**PATIENTS AND METHODS:**

**Setting and Patients:**

This is a cross-sectional based-hospital study that was conducted at the National Cancer Institute (NCI), Gezira University, Wad Medani, and Sudan. Sudanese males with PCa attending the National Cancer Institute from 2020 to 2021.

**Study Population**

Known prostate cancer clinically and histopathological proven to have prostatic cancers. Through transurethral resection of the prostate (TURP) or Transurethral electro vaporization of the prostate (TVP) or Transrectal Ultrasound guided prostate biopsy (TRUS) and had PSA more than 4.00 ng/mL.

**Anthropometric Measurements**

Weight, height and body mass index were measured. All patients’ height and weight were taken. Body mass index was obtained using formula

\[
\text{BMI} = \frac{(\text{Weight})(\text{Kg})}{(\text{Height})^2(\text{m})^2}
\]

**Inclusion Criteria**

All patients during study period newly confirmed diagnosed with PCa following histopathological examination or they were at advanced stage of the disease and were under radiation therapy will be enrolled in this study.

**Exclusion Criteria**

Patients with PCa excluded from this study if they are severely illness, renal diseases, malabsorption, hyperparathyroidism, any other cancer, and users of calcium lowering therapy, and those who taking vitamin D supplements.

**Sampling and Vitamin D Measurement:**

**Collection of blood:**

2.5ml venous blood sample was obtained from each patients using standard venipuncture technique. Plasma specimens were collected as heparinized container after centrifugation at 3000 rpm for 5 minutes. Then plasma was Pipette into a clean plastic screw-cap vial and attaches the label.

**Vitamin D and PSA Assay**

Vitamin D and PSA was measured by Electrochemiluminescence (ECL) immunoassay reactions using (Cobase411, serial No: 0868-16, manufactured by Hitachi high technologies corporation, Tokyo-Japan) the Elecsys reagents kit (Roche – Germany) was used, Elecsys reagent kits. Specify the cut-off values were:

- < 20 ng/ml is considered to be vitamin D deficiency.
- 21-29 ng/ml is considered to be insufficient.
- >30 ng/ml is considered to be normal.
- >100 ng/ml is considered to be toxic.

**Data analysis:**

Data was analyzed by SPSS software version (22) Patient clinico-demographic and anthropometric characteristics were presented as frequencies (n and %), mean ± standard deviation (SD) and range of values. The ANOVA test was used to assess the differences of vitamin D between groups. A p-value ≤0.05 was considered as statistically significant.

**Ethical approval:** Each participant was informed about the goal of the study and signed an informed consent before participation. The ethical committee at the Gezira State Health Ministry and the National Cancer Institute, University of Gezira, approved this study.

**RESULTS**

**Socio-demographic characteristics of study population:**

Overall, 86 PCa patients attending National Cancer Institute were enrolled. PCa patients were in the age group of <70 years representing 51%, and 49% in age group >70 years. The mean and median age was 71.78 ± 8.04 and 70 years, respectively. Only 12% of them were currently unmarried being divorced, widowed or separated while the remaining 88% were married. 68% of the participants were from Gezira state followed by Sinner 14%. Education-wise, 76% of PCa patients had secondary school level while 20% and 4% were reported to have higher school and university levels, respectively. 37% had BMI, and the remaining 36%, and 12% men were daily workers and other type jobs. Majority of PCa patients were at Gleason Stage of 7 to 10 which accounted for 79%, while the remaining 14%, 5% and 2% were at 6, 4 and 3 Gleason Stage, respectively. 27% had BMI, and the remaining 36%, and 12% men were daily workers and other type jobs. Majority of the patients (86%) hasn’t family history with cancer.(57%) of patients involve bone metastasis, vitamin D deficiency constitute about (12.8%) while Insufficient(19.8% ) (Table 1).
**Table 1:** Socio-demographic and clinical characteristics of the study Sudanese population with prostate cancer. Data shown are frequencies (n and %).

| Characteristics          | n   | %   |
|--------------------------|-----|-----|
| **Age, Years**           |     |     |
| <70                      | 44  | 51  |
| >70                      | 42  | 49  |
| **Total**                | 86  | 100 |
| **State of Residence**   |     |     |
| Alqadarif                | 6   | 7   |
| Blue Nile                | 2   | 2   |
| Gezira                   | 56  | 68  |
| Kordofan                 | 2   | 2   |
| River Nile               | 2   | 2   |
| Sinner                   | 12  | 14  |
| West Kurdufan            | 1   | 1   |
| White Nile               | 3   | 4   |
| **Total**                | 86  | 100 |
| **Marital Status**       |     |     |
| Divorced                 | 1   | 1   |
| Married                  | 76  | 88  |
| Single                   | 2   | 3   |
| Widower                  | 7   | 8   |
| **Total**                | 86  | 100 |
| **Education Level**      |     |     |
| Higher school            | 17  | 19.8|
| Illiterate               | 23  | 26.7|
| Preprimary               | 15  | 17.4|
| Primary                  | 26  | 30.2|
| Secondary school         | 1   | 1.2 |
| University               | 4   | 4.7 |
| **Total**                | 86  | 100 |
| **Gleason Stage**        |     |     |
| 3                        | 2   | 2.3 |
| 4                        | 4   | 4.7 |
| 6                        | 12  | 14  |
| 7                        | 18  | 20.9|
| 8                        | 20  | 23.3|
| 9                        | 22  | 25.6|
| 10                       | 8   | 9.3 |
| **Total**                | 86  | 100 |
| **Gleason Grade**        |     |     |
| I                        | 18  | 20.9|
| II                       | 7   | 8.1 |
| III                      | 9   | 10.5|
| IV                       | 22  | 25.6|
| V                        | 30  | 34.9|
| **Total**                | 86  | 100 |
| **Body Mass Index**      |     |     |
| Underweight              | 7   | 8.1 |
| Normal weight            | 33  | 38.4|
| Overweight               | 30  | 34.9|
| Obese                    | 16  | 18.6|
| **Total**                | 86  | 100 |
| **Family History of cancer** |   |   |
| No                       | 74  | 86  |
| Yes                      | 12  | 14  |
| **Total**                | 86  | 100 |
| **Bone metastasis**      |     |     |
| No                       | 37  | 43  |
| Yes                      | 49  | 57  |
| **Total**                | 86  | 100 |
| **Vitamin D Level**      |     |     |
| vitamin D deficiency     | 11  | 12.8|
| Insufficient             | 17  | 19.8|
| Normal                   | 58  | 67.4|
| **Total**                | 86  | 100 |
They were mild deceased in vitamin D level in obese with when compared with non-obese (35.5± 15.4 and 38.4 ±16.2) without significant differences (P=0.505) also there was decrease of serum PSA among obese when compared with non-obese (241.6 via 422.1) without significant differences (P=0.351) (table 2).

| Table 2 |
|--------------------------------|
| Obese and non-obese | N | Mean | Std. Deviation | P-Value |
|----------------------|---|------|----------------|---------|
| PSA                  |   |      |                |         |
| Obese               | 16| 214.6| 222.4          | 0.351*  |
| Non Obese           | 70| 422.1| 915.7          |         |
| Vitamin D Level     |   |      |                |         |
| Obese               | 16| 35.5 | 15.4           | 0.505   |
| Non Obese           | 70| 38.4 | 16.2           |         |

*The Mann-Whitney test

They were weakly insignificant negative correlation between BMI and vitamin D and PSA (r = -0.031, P = 0.778) and (r = -0.062, P = 0.569) respectively, also there were insignificantly Positive correlated between PSA and vitamin D level (r = 0.151, P = 0.164) (table3).

| Table 3 |
|--------------------------------|
| | PSA | Vitamin D Level | BMI |
|--------------------------------|
| PSA | Pearson Correlation | 1 | 0.151 | -0.062 |
|     | Sig. (2-tailed)     | 0.164 | 0.569 |
| N   | 86 | 86 | 86 |
|--------------------------------|
| Vitamin D Level | Pearson Correlation | 0.151 | 1 | -0.031 |
|     | Sig. (2-tailed)     | 0.164 | 0.778 |
| N   | 86 | 86 | 86 |
|--------------------------------|
| BMI | Pearson Correlation | -0.062 | -0.031 | 1 |
|     | Sig. (2-tailed)     | 0.569 | 0.778 |
| N   | 86 | 86 | 86 |

DISCUSSION:

Sociodemographic analysis of participants showed that majority of patients were from Gezira state and, others were coming from all over the Sudan. This may be explained by the fact that this study conducted at National Cancer. Age distribution of participants in the current study showed predominance of advance age among PCa patients with a mean age which was lower than studies done in Sudan, but higher than another Sudanese study and then another report from Uganda. This variation in result may be due to variation in sample size among studies, also the increased of age among PCa patient may due to absent of screening program for prostate cancer in Sudan. Majority of patients were present with advanced local stage of disease. This is similar to different studies conducted in Sudan. This finding may be due to lack of awareness among Sudanese and absence of screening program for prostate cancer in Sudan.

There were insignificant differences between vitamin D level and obesity this finding agree with Nair-Shalliker V et al. Also there were insignificant negative correlation between BMI and vitamin D level, this finding is consistent with the results of several publications demonstrating a negative correlation between that the vitamin D levels and BMI. Moreover, Seo et al. also found that age was negatively correlated with BMI.

Seo et al reported that higher BMI was associated with lower PSA levels. But the correlation was much weak, this finding in line with our finding in week correlation but it contrary to Seo et al and LiminYue et al. finding that our result failed to find significant correlation. A study from Jeong et al. illustrated that PSA level was confirmed to increase with decreasing BMI, which was in correspondence with our research.

CONCLUSION:

There were negative correlation between BMI and Serum vitamin D and PSA level among patients with prostate Cancer.

REFERENCES

1- Siegel RL, Miller KD, Jemal A. Cancer statistics, 2015. CA Cancer J Clin. 2015; 65(1):5-29. https://doi.org/10.3322/caac.21254
2- Rashid M, Shamshevalli K, Chhabra M. Efficacy and Safety of Nilutamide in Patients with Metastatic Prostate Cancer who Underwent Orchiectomy: A Systematic Review and Metaanalysis. CurrClinPharmacol. 2019; 14(2):108-115. https://doi.org/10.2174/15748847146661901121151202
3- Guh DP, Zhang W, Bansback N, Amarsi Z, Birmingham CL, Anis AH. The incidence of co-morbidities related to obesity and overweight: a systematic review and meta-analysis. BMC Public Health. 2009;9:88. Published 2009 Mar 25. https://doi.org/10.1186/1471-2458-9-88
