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ABSTRACT

Introduction: The burden of prostate cancer in Nigeria is the highest in Africa, with a handful of studies reporting the prevalence of the disease mostly from urban areas. There is a paucity of data on the disease prevalence in men in rural underserved areas of Nigeria, which make up over 45 % of the >200 million population. This study, therefore, investigated the Prostate-Specific Antigen levels among Men living in a rural community in Kogi state, Nigeria.

Methods: In this descriptive cross-sectional community-based study, a non-probability convenience sampling technique was used to select the participants. As part of the cancer awareness campaign of the Dove-Haven Foundation, blood samples from 33 men were screened for Prostate-Specific Antigen (PSA) in the rural areas of Yagba East Local Government Area of Kogi state, Nigeria.

Results: The mean age of participants was 52.5 years. The range of PSA values obtained was 0.1 - 77 with mean value of 4.06. Of the participants tested, 8.8 % had PSA levels of >4 ng/mol, while 2.9 % had PSA levels of >76 ng/mol. These participants have been recommended for direct rectal exams to rule out early prostate cancer.

Conclusion: Our result showed that there were high levels of Prostate-Specific Antigen among the Men living in this rural community. This underscores the importance

of prostate screening exercises in rural underserved communities to enhance early detection and reduce prostate cancer burden.

Keywords: Prostate cancer, screening, rural community, Kogi state, Nigeria

INTRODUCTION

Prostate cancer (PC) is one of the leading types of cancer in men, second only to skin cancer.¹ It has been frequently reported as the leading cause of death following lung cancer in men in the United States.² The lowest yearly incidence rates are seen in Asia, while the highest occur in North America and Scandinavia, especially among African Americans.² The burden of cancer is highest in most developed nations, e.g., France, Ireland, and Sweden; however, death rates are heaviest in developing nations, with 3 African countries among the top 10 countries with the highest rates when adjusted for age.³ While over 1.1 million cases were recorded in 2012, the disease accounted for about 8% of all new cancer cases worldwide and 15% of cancer cases in men.³ In Nigeria, prostate cancer is currently the most common cancer and the most common cause of cancer death in men, yet, studies continue to report a rising incidence and late presentation of prostate cancer in the referral centres.⁴⁻⁵ According to GLOBOCAN/IARC 2022, Nigeria accounted for approximately 17.7% of new prostate

cancer cases and 20.8% of prostate cancer deaths across Africa.⁴

From the last decade of the twentieth century till the present, a pattern of reduced death rates generally seen in developed countries can be attributed to advances in advocacy, early screening/ sensitization and medical interventions. Although international guidelines from developed countries differ on prostate cancer screening, resulting in some controversy regarding medical interventions, these nations still record an increased 5-year and 10-year survival rates in about 98% altogether.⁶⁻⁷ In developing countries, however, the situation is the opposite. A rapidly increasing population growth coupled with gaps in screening timing and easily accessible medical interventions aside from other factors such as genetics, environment and lifestyle has resulted in a poor prognosis for PC patients in these countries.⁸ Specifically, PC has become the most prevalent male malignancy in West Africa, including Nigeria.^{3,9} Several reports from studies of PC in Nigeria had documented an increased prevalence from the 8th most common cancer type in adult males in 1960 to the 1st most common in men and 4th overall cancer type in Nigeria as of 2008.¹⁰⁻¹¹ One-third of the cases of prostate cancer are preventable, and another-third are curable if detected early through screening. Although there is no consensus as regards guidelines for prostate cancer screening. Large-population studies have shown increased survival benefits in the early treatment of prostate cancer following screening.

Prostate-specific antigen (PSA) is a protein made by cells in the prostate gland and found in semen, but a small amount is also present in blood.¹² PSA has been used in screening tests for Prostate cancer. The chance of having prostate cancer increases as does PSA level, but there is no delineated point to indicate PC.¹³⁻¹⁴ Hence, it is largely used for screening purposes only among other biomarkers, especially in resource-limited settings. PSA levels <4 ng/mol have often been considered normal.¹²

For this study, PSA levels were assessed in a population of rural men living in an underserved rural community of a confluence state (where two major rivers, Niger and Benue meet as well as a main route pass to Northern Nigeria) – Kogi state in Nigeria. This study became imperative to juxtapose the prevalence of the disease in rural areas in concert with urbanized zones as well as to assess the need for recommendations to specific tests and diagnosis in designated centres. These latter objectives firmly anchored within the 3rd Sustainable Development Goal of “ensuring healthy lives and promoting well-being for all at all ages” of the United Nations are part of the multipronged approach to cancer research at the Department of Medical and Research of the Dove-Haven Foundation, Nigeria.

METHODS

Description of Study Setting

Nigeria, with a total population of approximately 217 million people in 2023, has more than 60 million adults in the rural areas and approximately 35 million others in the cities.¹⁵ This study was conducted in Kogi state, located in the North Central region of Nigeria. Yagba East Local Government Area (Figure 1) was selected in the state due to logistical reasons and accessibility. The average population and population density of the study area is approximately 200,000 and 142.4/km² covering a land area of about 1,397 km², respectively.¹⁶ A poorly equipped primary healthcare facility serves this population, which makes the study of this underserved community more imperative to ensure early diagnosis and treatment. Hence, this investigative study was performed alongside prostatic cancer screening exercises conducted by the Dove-Haven Foundation in the community.

Study Design and Population

A descriptive cross-sectional community-based study was used for this study. The study population were adult men who were permanent residents of the community. The inclusion criteria to select the participants for the PSA screening were set. Men between the

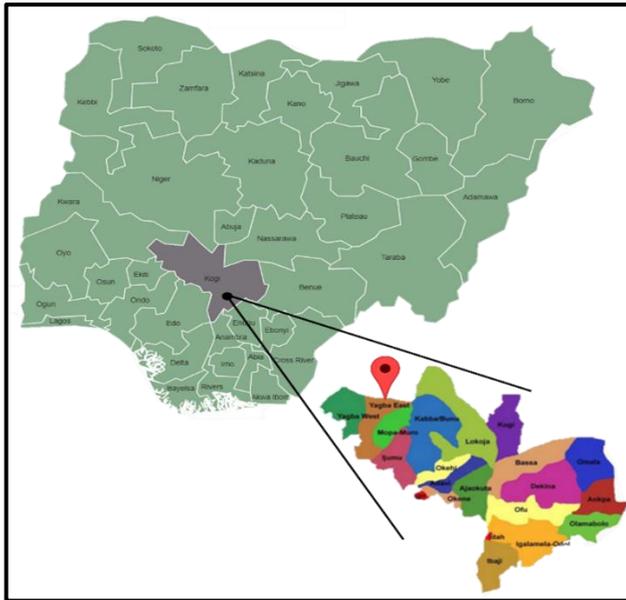


Figure 1: Showing the map of Nigeria, the confluence state-Kogi (shaded grey) and the study location- Kogi; Yagba East Local Government area (extracted with the red locator).¹⁷

ages of 40-70 years were included through a non-probability convenience sampling technique. Men with a previous history of prostate cancer, prostate surgery, or who declined consent were excluded from participation. Thirty-three (33) men were tested during the rural community screening. Demographics were obtained, and blood samples were collected in lithium heparin bottles. The latter were immediately placed in iced packs and sent to the laboratory for PSA assay.

Sample processing

Samples collected were processed using a Hybritech-free prostate-specific antigen (PSA) assay kit, which employs a two-site immune-enzymatic "sandwich" assay. Samples were added to a reaction well with mouse monoclonal anti-free PSA alkaline phosphatase conjugate and paramagnetic particles coated with a second mouse monoclonal anti-free PSA antibody. Free PSA in the sample binds to the immobilized monoclonal anti-free PSA on the solid phase, and simultaneously, the monoclonal anti-PSA conjugate reacts with a different antigenic site on the sample-free PSA. Separation in a magnetic field and washing removes material

not bound to the solid phase. A chemiluminescent substrate was added to the reaction vessel, and light generated from the reaction was measured with a luminometer. The degree of luminescence was proportional to the concentration of free PSA in the sample. The quantification of the sample analyte was determined with a multi-point calibration curve. Participants with abnormal results were counselled and referred for digital rectal examination (DRE) and further urological evaluation at the University College Hospital, Ibadan.

Ethics considerations

The research adhered to ethical principles, ensuring participant confidentiality, informed consent, and respect for the participants autonomy. Participation in the study was purely voluntary. Informed consent was obtained from the participants following a detailed brief on the study. The confidentiality of data as an ethical principle was ensured in the study after obtaining permission from the supervising local government health ministry.

Data analysis

SPSS was used for statistical analysis with mean and standard deviation of continuous variables determined. Pearson's correlation between the level of PSA and the age of the patient was also determined.

RESULTS

The mean age and standard deviation of participants was 52.5 ± 7.8 years with age range from 40 - 70 years. The range of PSA values obtained was 0.1 - 77 with mean value of 4.06. When age of participants was considered, Pearson's correlation was 0.3 which shows a mild positive correlation between PSA tests and age of participants. Of the participants tested, 8.8 % (3) had PSA levels of >4 ng/mol and were recommended for direct rectal examination (DRE), while 2.9 % (1) had PSA levels of >76 ng/mol (Figure 2) and was recommended for possible DRE and prostatic biopsy.

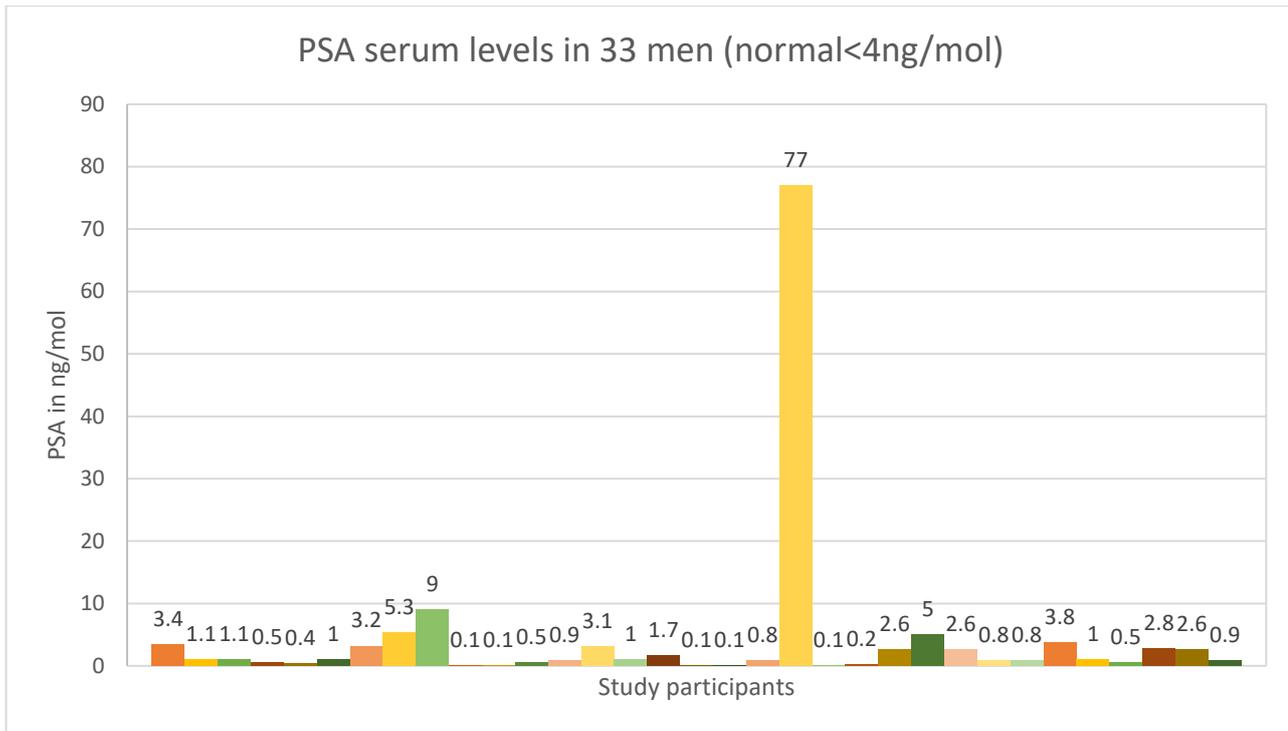


Figure 2: Showing serum PSA (ng/mol) levels in 33 screened men in rural underserved area of Yagba East Local Government, Kogi state, Nigeria.

DISCUSSION

Our results revealed that among men in the rural underserved area of Yagba East Local Government, cases of elevated PSA were present. Elevated PSA level could be an indicator of early prostate cancer cases with further tests conducted, as we recommended. However, only about 25% of men who have a prostate biopsy due to an elevated PSA level were reported to have prostate cancer.^{11, 18} Meanwhile, the positive correlation between PSA tests and age of participants in our study corroborates earlier reports where the authors stated that PSA level correlates with advancing age and prostate volume.^{19,20}

A study by Aisuodionoe-Shadrach et al. indicated that the prevalence of PC diagnosed in hospitals located in urban areas, such as Abuja, the federal capital territory of Nigeria, was reported to be at 38.7 % and nationwide between 2 - 11 %.²¹ It shows a higher prevalence of prostate cancer in these areas. It might also be because Abuja is an urban area where people are closer to health facilities and

are more open to prostate screening. There are fewer independent data that evaluated the burden of prostate cancer in rural or suburban underserved areas.²² Our study has provided insight into the suspected presence of this condition in rural areas. However, if screening is carried out on a larger scale, figures could surprisingly show a similar disease burden as urban dwellers. The real impact of prostate cancer in Nigeria on a larger scale is purportedly hampered by a lack of awareness and education, irregular screening, and lack of access to health care and screening facilities.²³ These factors are more pronounced and direr when the steadily growing rural communities which currently make up 64 % of the 153 million Nigerian population, are considered.²⁴⁻²⁵ This study, the first of many planned studies, is limited in scope by the number of participants and study area accessibility and coverage logistics.

CONCLUSION

The results from this study showed that there were high levels of Prostate-Specific Antigen among the men living in this rural community, which underscores the importance of prostate screening exercises in rural underserved communities to assess prostate cancer burden and begin early intervention to treat the disease if diagnosed. Further extensive studies need to be carried out, especially in rural communities where access to amenities is not available.

Recommendation: We recommend further prostate cancer screening activities in all rural areas of the six geopolitical zones of Nigeria. Such studies will reveal the cross-sectional prostate cancer burden in rural areas of Nigeria and the distribution and will help inform the right policies to address the burden.

Conflict of interest: The authors declared none.

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