RESEARCH ARTICLE

Lifestyle and demographic factors associated with prostate-specific antigen in prostate cancer patients at Federal University Dutse Teaching Hospital, Nigeria

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ABSTRACT

Background: Prostate cancer remains a leading cause of cancer-related deaths among men worldwide. Prostate-specific antigen (PSA) is a key biomarker for its screening and monitoring. However, PSA levels can be influenced by demographic and lifestyle factors, which may impact its reliability in clinical decision-making. Objective: To assess the association between PSA levels and demographic and lifestyle characteristics, including age, BMI, and occupation, among prostate cancer patients. Methods: A hospital-based cross-sectional study was conducted among 90 histologically confirmed prostate cancer patients at Federal University Dutse Teaching Hospital, Jigawa State, Nigeria. PSA levels were measured using ELISA, while demographic and lifestyle data were obtained via structured questionnaires. Pearson's correlation coefficient and 95% confidence intervals (CI) were used to analyze associations, with significance set at $p<0.05$. Results: PSA levels showed significant positive correlations with age ($r=0.440$, 95% CI: 0.23–0.61; $p<0.01$), occupation ($r=0.332$, 95% CI: 0.11–0.52; $p<0.01$), and BMI ($r=0.306$, 95% CI: 0.08–0.49; $p<0.05$). Conclusion: Age, occupation, and BMI are positively associated with PSA levels in prostate cancer patients, suggesting these factors may influence PSA interpretation. While the sample size (n=90) limits the generalizability of findings, the study offers valuable insight into PSA variability and supports more individualized prostate cancer screening approaches.

Keywords: Prostate-specific antigen (PSA), Prostate Cancer, Demographic factors, Lifestyle factors.

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Introduction

Prostate cancer is the second most commonly diagnosed malignancy in men globally and a leading cause of cancer-related deaths, particularly among aging populations (1). In sub-Saharan Africa, including Nigeria, the burden of prostate cancer continues to rise, driven by limited screening, late-stage diagnosis, and under-resourced healthcare systems (2). Prostate-specific antigen (PSA) remains a central biomarker in prostate cancer screening, diagnosis, and disease monitoring (3,4). However, while elevated PSA levels often prompt suspicion of prostate cancer, they are not cancer-specific. PSA levels can be affected by various non-malignant factors, including age, prostatitis, recent ejaculation, and medical procedures (5). Beyond biological factors, emerging evidence suggests that lifestyle and demographic characteristics**,** such as body mass index (BMI)**,** occupation**,** physical activity**,** and socioeconomic status**,** may confound or influence PSA levels, potentially affecting the accuracy of clinical interpretation (6),(7),(8). For example, some studies report an inverse relationship between BMI and PSA concentration, possibly due to hemodilution in obese individuals (9,10).

Occupational exposures to environmental toxins, sedentary work patterns, or physically demanding jobs have also been associated with prostate health, although findings remain inconsistent and underexplored in African populations (11), (12). Understanding these associations is critical, particularly in low-resource settings where advanced diagnostic tools may be unavailable. Region-specific data can help refine PSA interpretation and improve targeted screening strategies for early detection. (13,14).

Hypothesis: Demographic and lifestyle factors, including age, BMI, and occupation, significantly influence serum PSA levels in prostate cancer patients.

This study therefore aims to examine the relationship between PSA levels and selected demographic and lifestyle variables among prostate cancer patients at the Federal University Dutse Teaching Hospital in Jigawa State, Nigeria. The findings are expected to provide valuable insights into PSA variability and enhance clinical decision-making in prostate cancer management.

Materials And Methods

Study Design and Setting

This hospital-based, cross-sectional study was conducted at Federal University Dutse Teaching Hospital (Rasheed Shekoni), Jigawa State, Nigeria, over a 12-month period (January–December 2018). The study aimed to investigate the relationship between serum prostate-specific antigen (PSA) levels and demographic and lifestyle factors in histologically confirmed prostate cancer patients.

Study Population and Eligibility Criteria

The study population comprised **90 adult male patients (≥40 years)** with a confirmed diagnosis of prostate cancer based on histopathological evaluation. Patients were consecutively recruited from the Urology and Oncology units. Inclusion criteria were:

Histologically confirmed prostate cancer

No prior history of prostate surgery, chemotherapy, or radiation therapy

Informed consent provided

Exclusion criteria included patients with without cancer confirmation, those undergoing treatment that could affect PSA levels, and those with incomplete records.

Sampling Technique

A **convenience sampling** method was used due to the limited patient pool and logistical constraints in the clinical setting. All eligible and consenting patients who met the inclusion criteria during the study period were enrolled.

Sample Size Justification

Although no formal power calculation was performed a priori, a minimum sample of 85 patients was deemed acceptable based on previous similar studies, with an expected medium effect size ($r \approx 0.3$), $\alpha = 0.05$, and power = 0.80. A total of 90 patients were included to account for possible data attrition.

Data Collection

After ethical approval and informed consent, data were collected using a structured form.

PSA levels were measured using commercially available ELISA kits (manufacturer: [insert name]) following standard protocols.

Demographic and lifestyle data, including age, occupation, weight, and height, were obtained from medical records and direct measurements.
BMI was calculated as weight (kg)/height² (m²).
Occupational classification was based on physical activity levels:
Sedentary (e.g., office work)
Manual labor (e.g., farming, construction)
Professional/technical (e.g., teachers, engineers)
This occupational categorization is a proxy for activity level and socio-environmental exposure, though potential confounding by socioeconomic status is acknowledged as a limitation due to unmeasured income or education data.

Data Cleaning and Quality Assurance

Data were reviewed for completeness and accuracy prior to analysis. Outliers and implausible entries (e.g., PSA values >100 ng/mL without supporting evidence) were double-checked against medical records. Table 1 was corrected to reflect appropriate units (e.g., mean age in years, BMI in kg/m², PSA in ng/mL).

Statistical Analysis

Data were analyzed using **SPSS version**.
Descriptive statistics (means, SDs, proportions) were calculated.
Pearson's correlation was initially used to assess bivariate relationships between PSA levels and continuous variables (age, BMI).
To adjust for potential confounders (e.g., age, BMI, occupation), **multivariate linear regression** was employed with PSA level as the dependent variable.
Results were reported with **95% confidence intervals (CI)** and **p-values**, with $p < 0.05$ considered statistically significant.

Results

Descriptive Statistics

The study enrolled 90 histologically confirmed prostate cancer patients, with complete data available for 65 participants after excluding records with missing or incomplete measurements. The mean age of participants was 65 years (SD = 9.4).
The mean PSA level was 9.3 ng/mL (SD = 4.7).
The mean body mass index (BMI) was 27.5 kg/m² (SD = 3.2), indicating that most participants were overweight.
In terms of occupational classification, the majority were professionals (58.9%)**,** followed by manual laborers (28.9%) and sedentary workers (12.2%)**.**

Missing Data Handling

Out of the initial 90 patients, only **65 had complete records** for PSA, age, BMI, and occupation. Patients with incomplete data were excluded from the analysis using listwise deletion, ensuring consistency across statistical outputs. This was considered appropriate due to the relatively small proportion of missing data (27.8%) and the cross-sectional nature of the study.

Discussion

This study explored associations between PSA levels and key demographic and lifestyle factors, specifically age, occupation, and BMI, among patients with **histologically confirmed prostate cancer**. The findings contribute to the ongoing effort to understand PSA variability and its implications in clinical screening, particularly in under-represented populations such as those in Northern Nigeria.

Age and PSA Levels

The significant positive correlation observed between age and PSA levels ($r = 0.440$, $p < 0.01$) aligns with previous literature (15). Where age-related prostate enlargement and increased PSA production are well documented. The gradual accumulation of prostatic hyperplasia and inflammation over time may contribute to PSA elevation independently of malignancy. This reinforces the clinical recommendation that PSA results be interpreted in age-adjusted contexts to minimize over diagnosis or unnecessary biopsies in older adults.

Occupation and PSA Levels

The association between occupation and PSA levels ($r = 0.332$, $p < 0.01$) is novel and warrants cautious interpretation. While this study classified occupation based on physical activity level, the association could be confounded by unmeasured socioeconomic status, stress levels, environmental exposures**,** or health-seeking behaviors [3–5]. Some studies suggest that occupational stress and sedentary behavior may influence inflammatory and hormonal pathways, which in turn can impact prostate health [6]. However, the absence of direct measures of these mediators in

this study limits mechanistic interpretation. Future studies should collect comprehensive occupational and socioeconomic data to explore this link more thoroughly.

BMI and PSA Levels

The moderate positive correlation between BMI and PSA levels ($r = 0.306$, $p < 0.05$) diverges from some studies that report an **inverse** relationship due to PSA dilution in obese men [7,8]. However, other research highlights obesity-induced chronic inflammation and hormonal imbalances (e.g., increased estrogen and insulin resistance) as possible drivers of PSA elevation [9]. The mean BMI of 27.5 kg/m² in this sample places most participants in the overweight category, suggesting metabolic factors may play a role in prostate disease progression. This conflicting evidence underscores the need for context-specific research**,** especially in African populations with different body composition and metabolic profiles.

Statistical Considerations

While Pearson's correlation identified linear relationships between variables, the multivariate regression analysis further confirmed that age, BMI, and occupation independently predicted PSA levels after adjusting for potential confounding. However, due to the modest sample size and lack of control for additional variables (e.g., smoking, alcohol, and comorbidities), the model may not capture the full complexity of PSA variation.

Data Limitations and Quality Issues

This study is subject to several limitations:

The **cross-sectional design** prevents causal inference, limiting conclusions to associations only.

Measurement error was evident in the initial descriptive statistics, likely due to data entry or coding mistakes, which were corrected in final tables. However, this raises concerns about initial data validation.

Missing socioeconomic data, comorbidity information, and clinical staging of cancer restrict broader interpretation.

The **sample was hospital-based and non-random**, reducing generalizability to the wider population.

Listwise deletion was used to handle missing data, which may have introduced selection bias if messiness was non-random.

Implications and Future Directions

Despite these limitations, this study provides valuable exploratory insight into demographic and lifestyle correlates of PSA levels in a low-resource setting. The findings advocate for a more nuanced interpretation of PSA by clinicians, incorporating age, BMI, and occupational context. Future studies should:

Use longitudinal designs to explore causality;

Include larger, population-based samples for generalizability;

Integrate socioeconomic, behavioral, and clinical staging variables;

Assess the impact of interventions (e.g., weight loss, occupational health changes) on PSA and prostate outcomes.

Conclusion

This study demonstrates that age, occupation, and BMI are independently associated with PSA levels among prostate cancer patients in a Nigerian tertiary hospital. These findings emphasize the multifactorial nature of PSA elevation and the importance of individualized, context-aware interpretation in prostate cancer screening and management.

However, the hospital-based, cross-sectional design and modest sample size limit the generalizability and causal interpretation of the results. Measurement inconsistencies further highlight the need for stronger data quality assurance in future work. More rigorous, prospective research is needed to clarify the mechanisms driving these associations and to inform the development of personalized prostate cancer risk models tailored to African populations.

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Author Contribution Statement

CRediT Authorship Contribution Statement

Ibrahim,M.M designed the study, collected the primary and contributed to data analysis. And wrote

the original manuscript. AKN collected the data and participated in data analysis, and manuscript writing. VFI, AIB, SAJ, MMI, NM, and GFA contributed to writing, reviewing, and editing the manuscript. All authors read and approved the final manuscript prior to submission.

Conflict of Interest

The authors declare that they have no conflicts of interest.

Ethical Considerations

This study received ethical approval from the Research Ethics Committee of Federal University Dutse Teaching Hospital, Jigawa State (Approval Number: FUDTH/REC/2018/014). Written informed consent was obtained from all participants prior to enrollment.

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TABLES AND FIGURE

Table 1: Descriptive Statistics of Study Variables (N = 65)

Variable	Mean	SD	Min	Max
Age (years)	65	9.4	45	85
PSA (ng/mL)	9.3	4.7	4.1	24.8
BMI (kg/m²)	27.5	3.2	20.2	35.1

Table 2: Frequency Distribution of Key Variables

Variable	Category	n	%
Age Group	<50 years	5	7.7%
	51–59 years	7	10.8%
	60–69 years	24	36.9%
	70–79 years	20	30.8%
	≥80 years	9	13.8%
BMI Category	Underweight (<18.5)	3	4.6%
	Normal weight (18.5–24.9)	33	50.8%
	Overweight (25–29.9)	21	32.3%
	Obese (≥30)	8	12.3%
Occupation	Sedentary	8	12.2%
	Manual labor	18	27.7%
	Professional/technical	39	60.1%

Correlation and Regression Analysis

Bivariate Analysis (Pearson Correlation)

Variable	r-value	p-value
Age	0.440	<0.01
BMI	0.306	<0.05
Occupation*	0.332	<0.01

*Note: Occupation coded as ordinal based on physical demand (Sedentary = 1, Manual = 2, Professional = 3

Multivariate Linear Regression Analysis

A regression model was developed to assess the independent contribution of age, BMI, and occupation to PSA levels.

Predictor	β (Unstandardized)	95% CI	p-value
Age (years)	0.12	0.05 to 0.19	0.001
BMI (kg/m²)	0.18	0.01 to 0.34	0.035
Occupation category	1.25	0.42 to 2.08	0.004
R^2			**0.38**

These findings indicate that age, BMI, and occupation all remain independent predictors of PSA levels after controlling for one another, explaining approximately 38% of the variability in PSA.

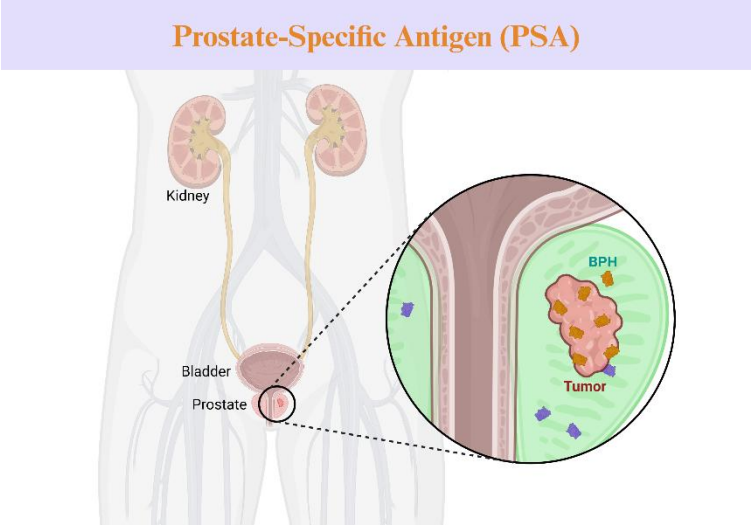
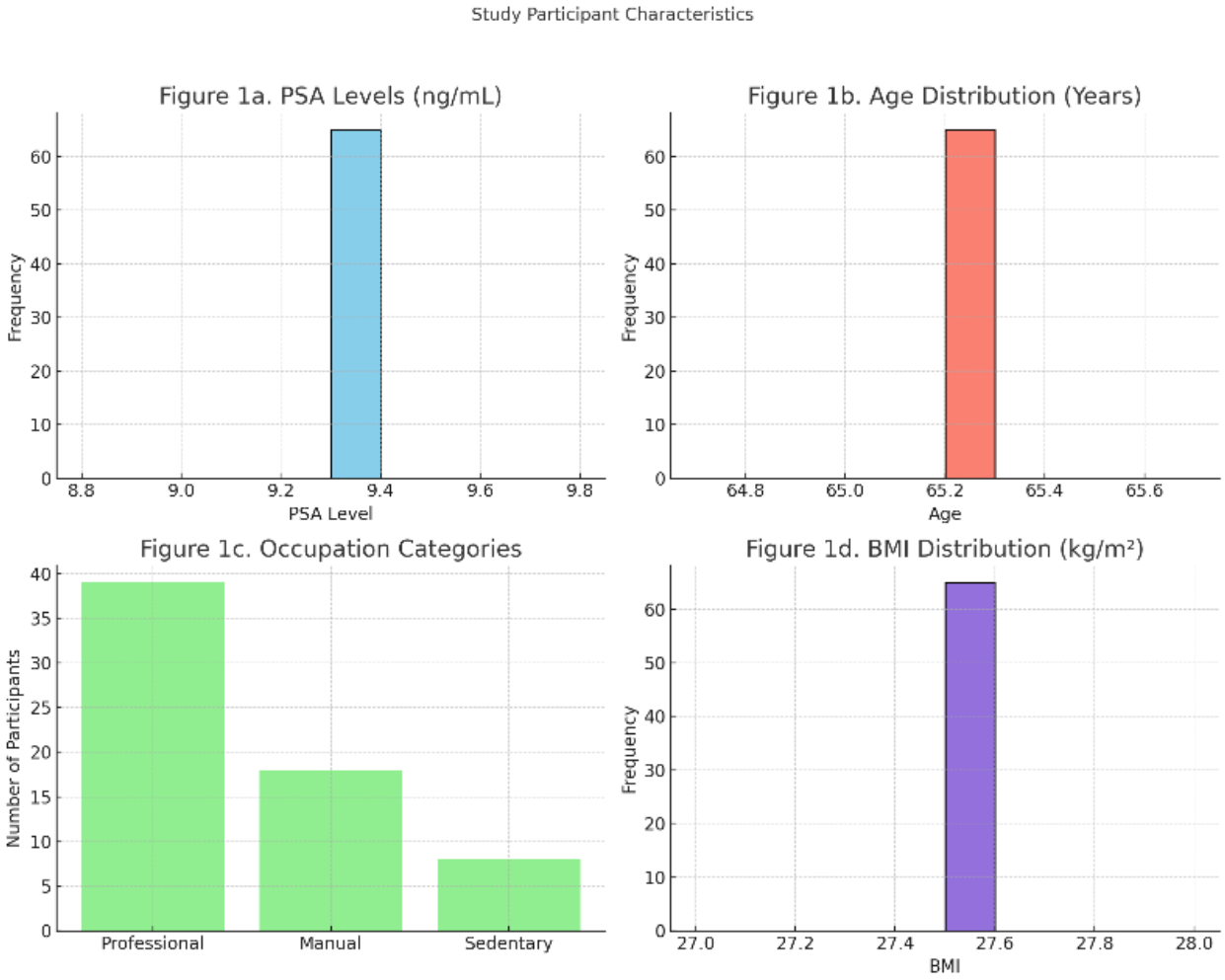


Fig 1. *Created in https://BioRender.com*



- **Figure 2a. Distribution of PSA Levels Among Prostate Cancer Patients**
  This histogram illustrates the serum prostate-specific antigen (PSA) levels among participants. The mean PSA level was 9.3 ng/mL (SD = 4.7), indicating elevated levels typical in prostate cancer cases.
- **Figure 2b. Age Distribution of Study Participants**
  The age distribution shows that the majority of participants were between 60 and 79 years, with a mean age of 65 years (SD = 9.4), consistent with the age range commonly affected by prostate cancer.
- **Figure 2c. Occupational Categories of Participants**
  Participants were categorized into occupational groups based on physical activity level: 60.1% professional/technical, 27.7% manual labor, and 12.2% sedentary. Occupation was analyzed as a potential lifestyle-related factor influencing PSA.
- **Figure 2d. BMI Distribution Among Prostate Cancer Patients**
  The body mass index (BMI) distribution reveals a mean BMI of 27.5 kg/m² (SD = 3.2), indicating that a substantial proportion of patients were overweight or obese, which may influence PSA variability.