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Qualitative Exploration of Relationships Between Prostate-Specific Antigen (PSA) Values, Age, Body Mass Index, Fasting Blood Sugar, and Family History Among Male Clergy Attending a Conference in Jos, Nigeria: A Cross-Sectional Study

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Abstract **Original Research Article**

Background: Prostate-specific antigen (PSA) testing is widely used in prostate cancer screening and monitoring, but PSA is not cancer-specific and may be influenced by benign conditions and individual risk factors [2,3].

Objective: To evaluate the relationships between PSA values and age, body mass index (BMI), fasting blood sugar (FBS), and family history of prostate cancer, adjusting for educational attainment.

Methods: A cross-sectional analysis was conducted among male clergy recruited at a two-day conference in Jos, Nigeria (May 2025). All consenting participants were enrolled and tested. PSA and FBS were measured from venous blood samples; BMI was computed from measured weight and height. Multivariable linear regression with heteroskedasticity-robust standard errors estimated associations, adjusting for education; a sensitivity analysis modeled log(PSA) among participants with PSA > 0.

Results: Data from 43 participants were analyzed. PSA was right-skewed (mean 1.48 ng/mL; median 0.60; range 0.0–12.3). Mean age was 55.6 years, mean BMI 32.2 kg/m², and mean FBS 5.78 mmol/L. In adjusted models, associations between PSA and age, BMI, FBS, and family history were modest and statistically non-significant; findings were similar in log(PSA) models. Conclusion: PSA variability in this sample was not strongly explained by age, BMI, fasting blood sugar, or family history after adjustment for education. Larger clinically characterized studies are required to clarify determinants of PSA in African populations [1,2].

Keywords: prostate-specific antigen, body mass index, fasting blood sugar, family history, education.

Introduction

Prostate cancer is among the most frequently diagnosed cancers in men worldwide and remains a major contributor to cancer burden [1]. PSA, a prostate-derived biomarker measured in blood, is commonly used for screening, risk stratification, and monitoring of prostate conditions; however, its use in population screening is debated because of potential harms, including false-positive results and overdiagnosis [2,3]. A key limitation is that PSA is not specific for malignancy. Elevated PSA may occur in prostate cancer as well as in benign prostatic hyperplasia and inflammatory conditions, making interpretation dependent on clinical context and individual risk [2]. Age and family history are well-established risk factors for prostate cancer, with meta-analyses demonstrating increased risk among men with affected relatives [6,7]. Metabolic factors may also influence PSA measurement and interpretation. Obesity has been associated with lower PSA concentrations in several cohorts, in part explained by plasma hemodilution, which can reduce measured PSA despite similar circulating PSA mass [4,5]. Given the need for context-specific evidence, this study assessed the relationships between PSA values and age, BMI, fasting blood sugar, and family history of prostate cancer among male clergy attending a conference in Jos, Nigeria, adjusting for educational attainment.

Literature review

PSA-based screening has contributed to earlier detection of prostate cancer but remains controversial due to a modest net benefit in some age groups and the risk of downstream harms [2,3]. PSA elevation is not diagnostic of cancer and may also occur in benign prostatic hyperplasia or prostatitis [2]. Family history is consistently associated with higher prostate cancer risk; meta-analyses demonstrate increased risk among men with affected first-degree relatives, with stronger associations in men with an affected brother compared with an affected father [6,7]. Obesity is inversely associated with PSA concentration in large screening and clinical cohorts. In the PLCO screening trial, PSA concentration decreased with increasing BMI while PSA mass was largely unchanged, supporting hemodilution as a mechanism [4]. Similar findings were demonstrated among men with prostate cancer undergoing radical prostatectomy, where higher BMI was associated with increased plasma volume and lower PSA concentration [5]. Evidence on other metabolic markers is less consistent; nonetheless, metabolic dysfunction may be relevant to prostate biology through endocrine and inflammatory pathways. These mixed findings underscore the importance of locally generated data to inform PSA interpretation in African settings.

Methods

Study design and setting

This was a cross-sectional descriptive analytical study conducted during a two-day conference of male clergy held in Jos, Nigeria, in May 2025.

Study population and recruitment

All male clergy attending the conference were approached for recruitment. Study information was provided, and participation was voluntary. All participants who provided written informed consent were enrolled and tested.

Eligibility criteria

Inclusion criteria were male clergy present at the conference; age ≥ 18 years; provision of written informed consent; and completion of PSA testing, fasting blood sugar (FBS) testing, and anthropometric measurements required for BMI calculation.

Exclusion criteria were refusal or inability to provide consent; non-completion of PSA or FBS testing; non-fasting at the time of blood collection for FBS; unsuitable blood samples; or incomplete data for key variables (age, PSA, BMI, or FBS).

Data collection and measurements

Age, educational attainment, and family history of prostate cancer were obtained using a structured proforma. Weight and height were measured, and BMI computed as weight (kg) divided by height squared (m^2). Venous blood samples were collected for measurement of PSA and fasting blood sugar. FBS was recorded in mmol/L (as documented on the study proforma/laboratory report).

Ethical considerations

Ethical approval was obtained from the Bingham University Health Research Ethics Committee. Written informed consent was obtained from all participants before enrollment, and confidentiality of participant information was maintained.

Statistical analysis

Data were cleaned and analyzed using Python (Python 3) with pandas, NumPy, and statsmodels. Continuous variables were summarized using means (standard deviations) or medians (interquartile ranges) as appropriate, while categorical variables were summarized using frequencies and percentages. Pearson correlation was used to assess relationships among continuous variables. Multivariable linear regression models with heteroskedasticity-robust (HC3) standard errors were fitted to evaluate associations between PSA values and age, BMI, FBS, and family history of prostate cancer, adjusting for educational attainment. A sensitivity analysis was conducted using log-transformed PSA among participants with PSA > 0. Statistical significance was set at $p < 0.05$.

Results

A total of 43 participants had complete data for PSA, age, BMI, fasting blood sugar, education, and family history and were included in the analysis. PSA values were right-skewed, ranging from 0.0 to 12.3 ng/mL (median 0.60 ng/mL).

Table 1 summarizes continuous variables, Table 1b shows categorical distributions, Table 2 presents Pearson correlations, and Table 3 provides multivariable regression estimates.

Table 1. Descriptive statistics for continuous variables.

Variable	Mean (SD)	Median (IQR)	Range
Age (years)	55.60 (5.70)	56.00 (5.00)	44.00–72.00
BMI (kg/m²)	32.20 (6.54)	31.25 (9.96)	21.16–44.38
FBS (mmol/L)	5.78 (2.78)	5.00 (1.25)	3.90–19.90
PSA (ng/mL)	1.48 (2.40)	0.60 (1.00)	0.00–12.30

Table 1b. Categorical distributions.

Variable	Category	n
Education	Tertiary	22
Education	Secondary	21
Family history of prostate	Yes	29

cancer		
Family history of prostate cancer	No	14

Table 2. Pearson correlations among continuous variables.

	Age	BMI	FBS	PSA
Age	1.00	0.15	0.27	-0.17
BMI	0.15	1.00	-0.03	-0.19
FBS	0.27	-0.03	1.00	-0.05
PSA	-0.17	-0.19	-0.05	1.00

Table 3. Multivariable regression estimates (HC3 robust SE).

Model	Predictor	Estimate	95% CI	Robust SE	p-value
Outcome: PSA (ng/mL)	Age (years)	-0.065	-0.252 to 0.121	0.095	0.493
Outcome: PSA (ng/mL)	BMI (kg/m²)	-0.068	-0.168 to 0.033	0.051	0.187
Outcome: PSA (ng/mL)	FBS (mmol/L)	-0.034	-0.191 to 0.124	0.081	0.677
Outcome: PSA (ng/mL)	Education: Tertiary vs Secondary	0.472	-1.52 to 2.464	1.016	0.643
Outcome: PSA (ng/mL)	Family history: Yes vs No	-0.252	-2.694 to 2.189	1.246	0.84
Outcome: log(PSA)	Age (years)	-0.003	-0.092 to 0.086	0.045	0.94
Outcome: log(PSA)	BMI (kg/m²)	-0.036	-0.094 to 0.022	0.03	0.225
Outcome: log(PSA)	FBS (mmol/L)	-0.031	-0.135 to 0.072	0.053	0.553

Outcome: log(PSA)	Education: Tertiary vs Secondary	0.056	-0.867 to 0.979	0.471	0.905
Outcome: log(PSA)	Family history: Yes vs No	0.075	-1.056 to 1.205	0.577	0.897

Figures

Figure 1. Distribution of PSA values.

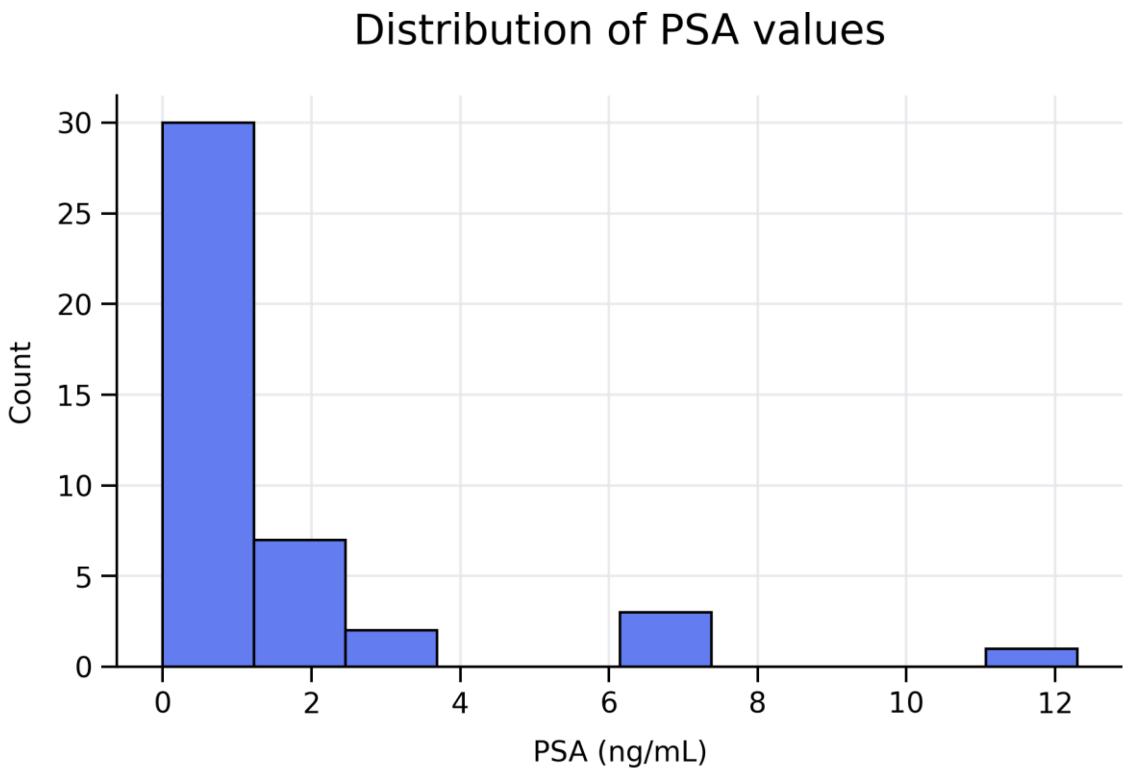


Figure 2. Boxplot of PSA values.

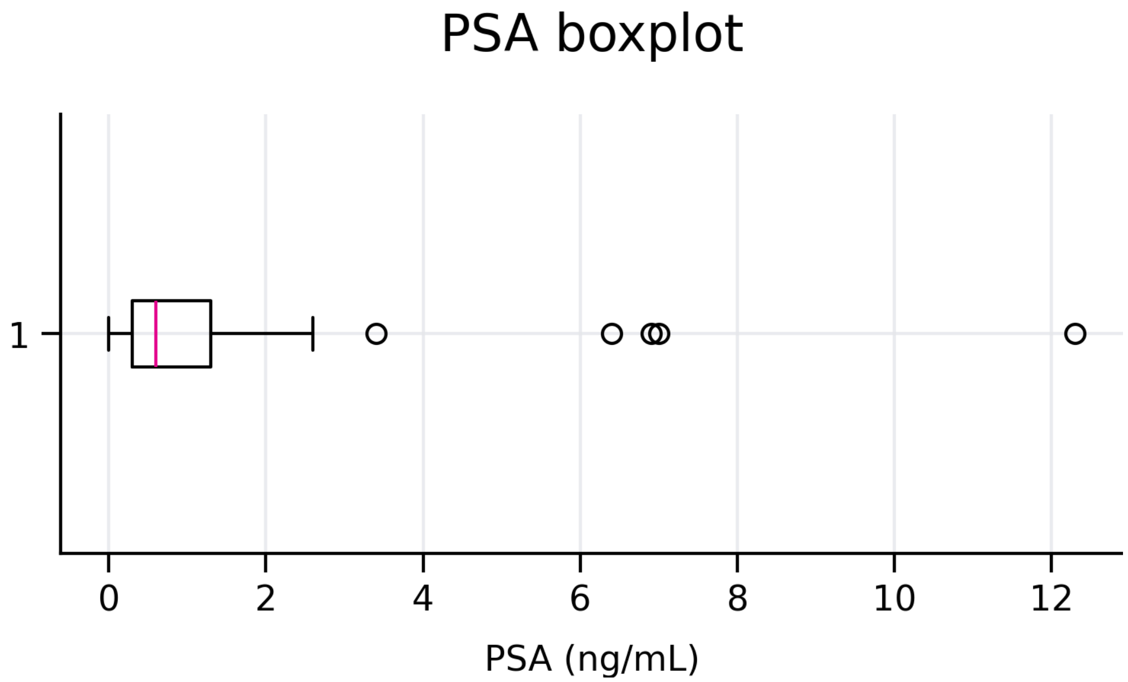


Figure 3. Scatterplot of PSA against age with fitted linear trend.

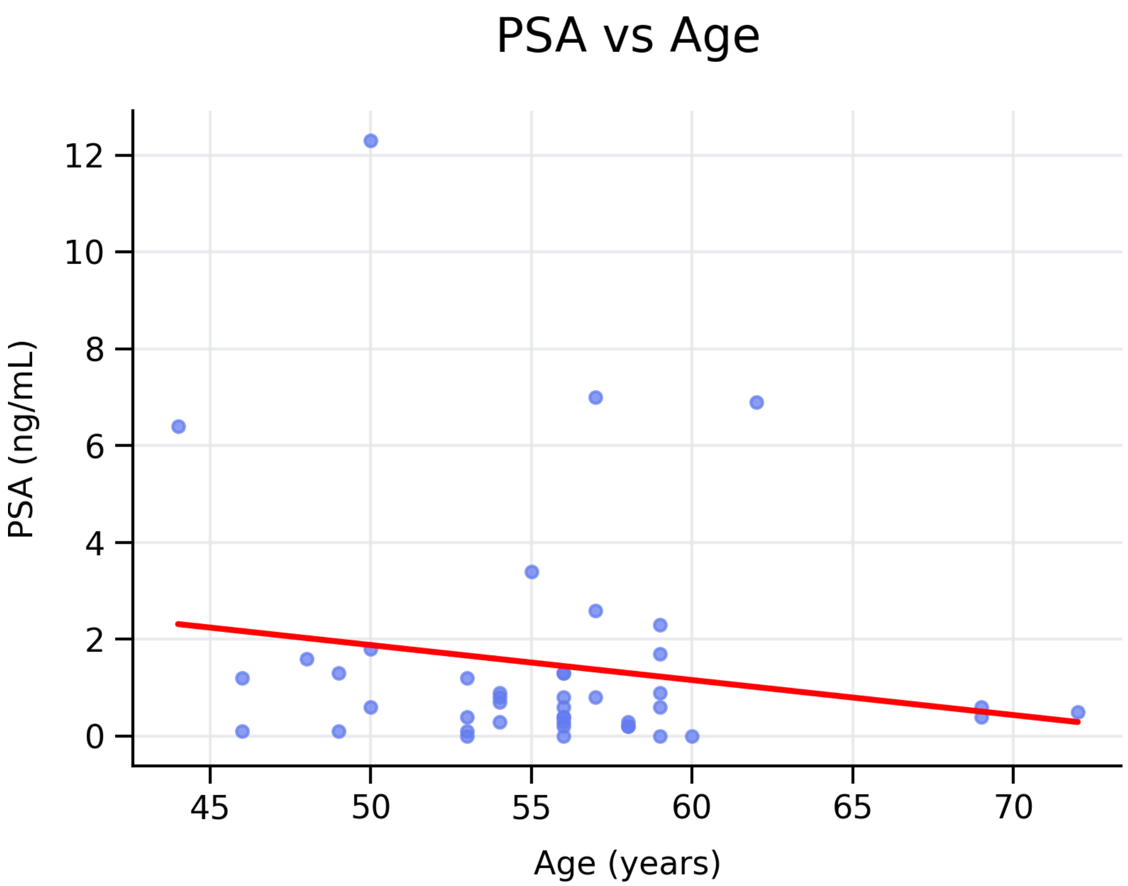


Figure 4. Scatterplot of PSA against BMI with fitted linear trend.

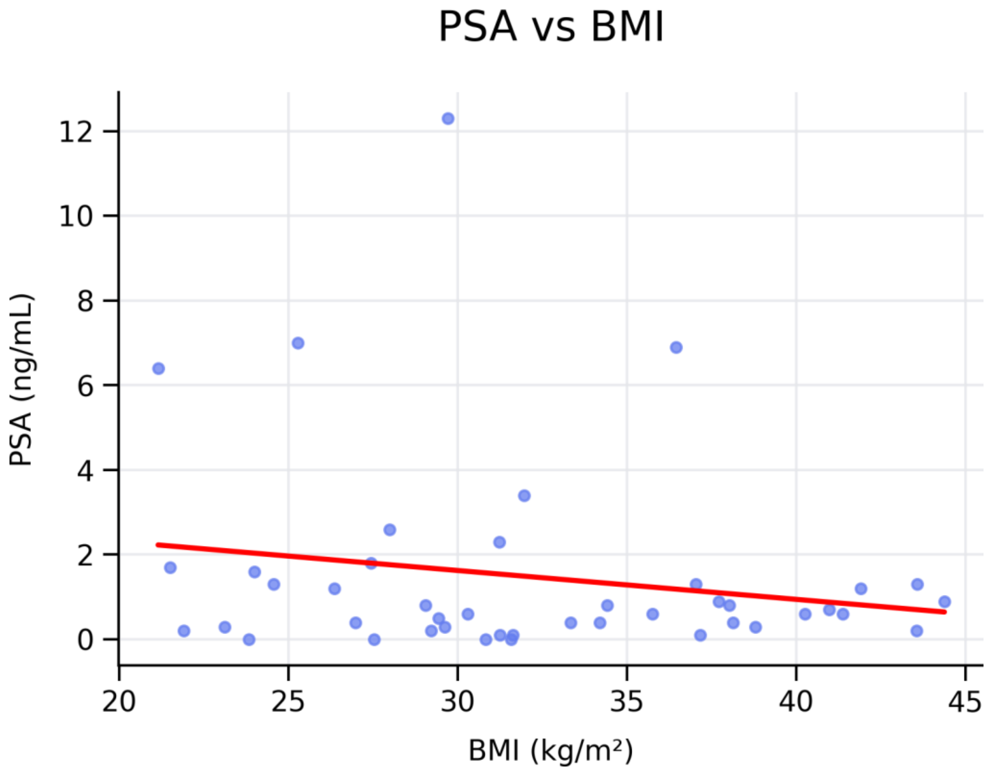


Figure 5. Scatterplot of PSA against fasting blood sugar with fitted linear trend.

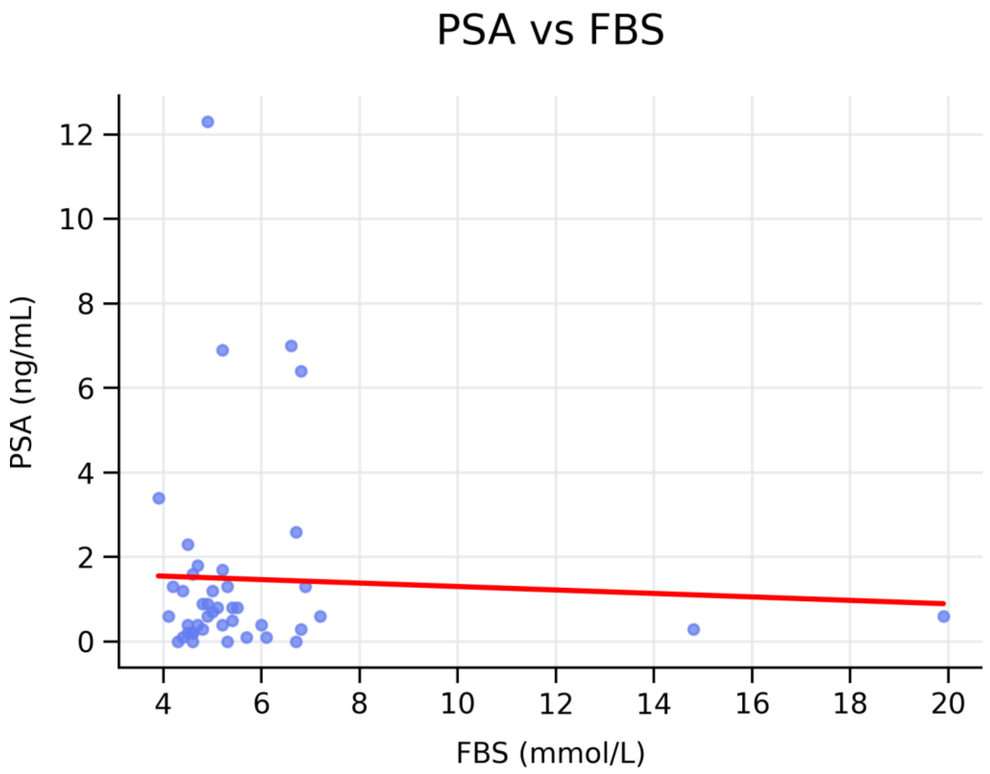


Figure 6. PSA distribution by family history of prostate cancer.

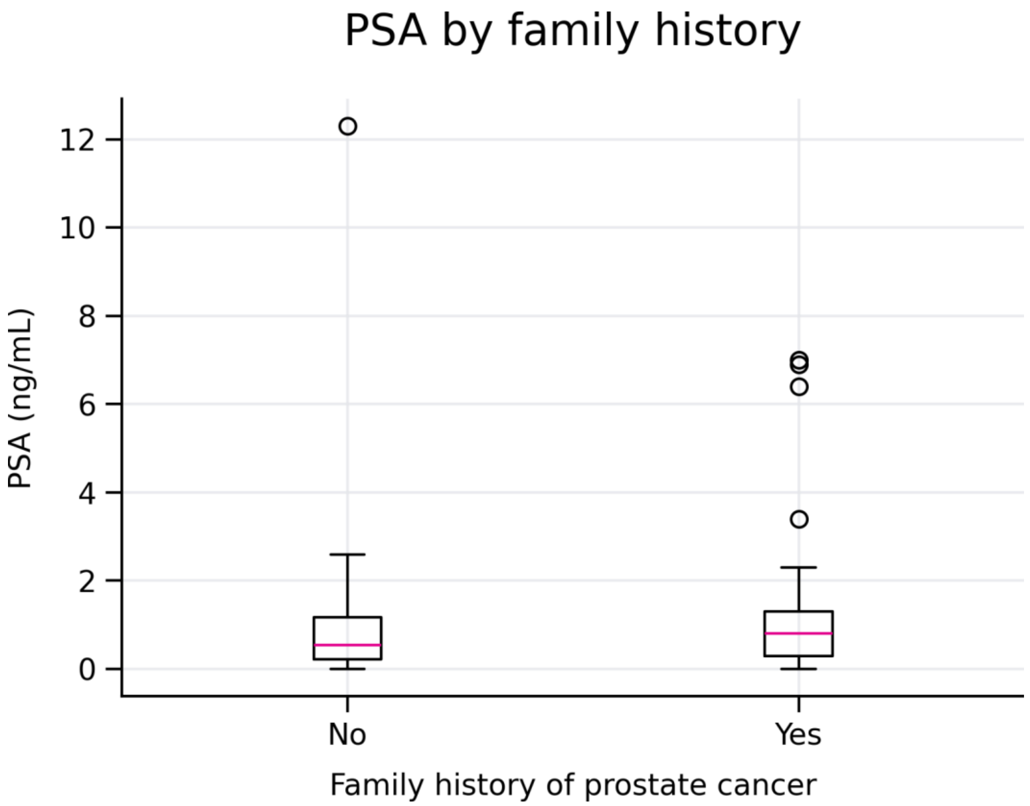


Figure 7. PSA distribution by education level.

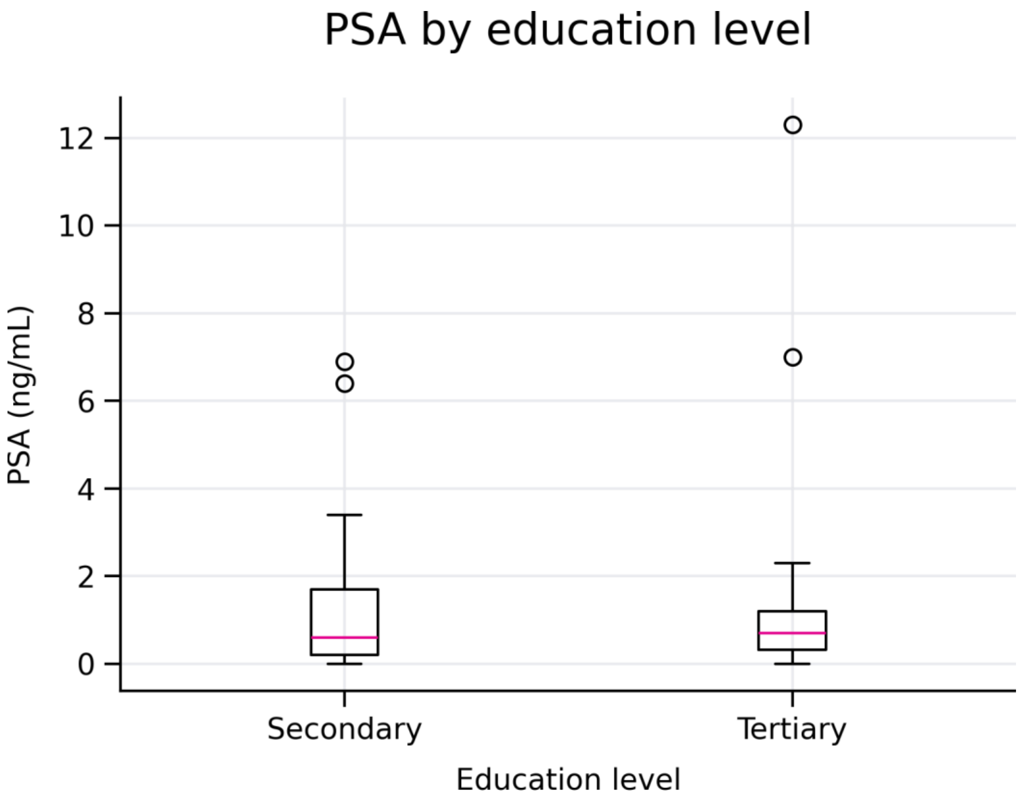
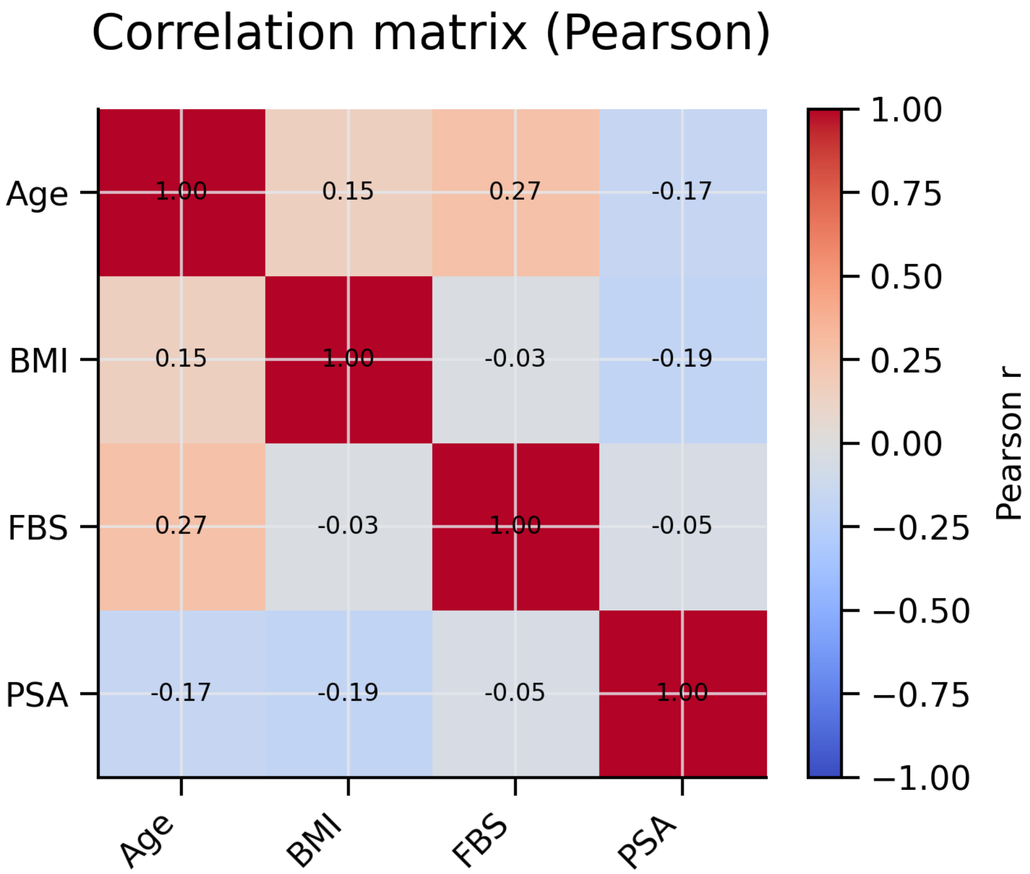


Figure 8. Pearson correlation heatmap for age, BMI, FBS and PSA.



Discussion

In this cross-sectional sample of male clergy, PSA values were right skewed with a small number of higher values. After adjustment for education, age, BMI, and family history, fasting blood sugar showed modest and imprecise associations with PSA. These findings are consistent with the broader literature highlighting the multifactorial determinants of PSA and the influence of non-malignant factors on PSA values [2]. The inverse association observed for BMI is consistent with reports of lower PSA concentrations among men with higher BMI, potentially due to hemodilution [4,5].

Limitations

The study was limited by its cross-sectional design and modest sample size, which reduced statistical precision. Family history was self-reported. Clinical assessment for benign prostatic hyperplasia, prostatitis, medication use, and prostate volume was not available, and these factors may influence PSA interpretation [2].

Conclusion

Among male clergy recruited at a conference in Jos, Nigeria, PSA values were not strongly associated with age, BMI, fasting blood sugar, or family history after adjustment for educational attainment. Larger studies incorporating clinical characterization are needed to better define PSA determinants in Nigerian populations.

Declarations

Ethics approval and consent to participate

Ethical approval was obtained from the Bingham

University Health Research Ethics Committee. Written informed consent was obtained from all participants before enrollment.

Consent for publication

Not applicable.

Availability of data and materials

Data are available from the corresponding author upon reasonable request.

Competing interests

The authors declare that they have no competing interests.

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