Original Research Article

PROSTATE SPECIFIC ANTIGEN LEVEL IN DIABETIC MEN AT BINGHAM UNIVERSITY TEACHING HOSPITAL JOS PLATEAU STATE NIGERIA

Abstract

The biomarker called Prostate Specific Antigen (PSA) is frequently employed for the early identification of prostate cancer. Numerous demographic, lifestyle, and health factors have been demonstrated to affect PSA levels in blood, therefore when interpreting test results, care should be taken to take these factors into consideration. The focus of this study is to evaluate the impact of Diabetes on PSA level in relation to their demographic characteristics. The study was conducted among 63 male subjects attending Bingham University Teaching Hospital (BHUTH). Subjects were classified into diabetic and non-diabetic groups (control group). The subjects who met the inclusion criteria were randomly selected and 3mls of blood was collected for PSA analysis using ELISA technique. In diabetic group, there was no significant difference in PSA level in each of the demographic parameters studied, p-value>0.05. In non-diabetic group, there was a significant difference in PSA level among the groups in Educational status, p-value=0.011 while other demographies did not report any significant change, p-value>0.05. There was no significant difference in PSA level between diabetic and non-diabetic groups, p-value>0.05. This study has shown Diabetes and demographic presentations have no effect on PSA level but educational status impacts on PSA level in normal individuals.

Keywords: *Demographic, diabetes, prostate specific antigen*

Introduction

The biomarker called Prostate Specific Antigen (PSA) is frequently employed for the early identification of prostate cancer. Numerous demographic, lifestyle, and health factors have been demonstrated to affect PSA levels in blood, therefore when interpreting test results, care should be taken to take these factors into consideration. In prostatic pathology, prostate specific antigen is one of the frequently employed clinical tumor markers. It is used as an immune-histochemical marker and a serological marker, and it has been discovered to be organ-specific for some reasons. [1]. The PSA test was initially approved by the FDA in 1986 to track the progression of prostate cancer in men who had previously been diagnosed with the disease. Men with prostate cancer usually have elevated blood levels of PSA. The PSA test and digital rectal examination (DRE) were both authorized by the FDA in 1994 for use in screening asymptomatic men for prostate cancer. Men who report prostate problems frequently have PSA testing (combined with a DRE) done to help medical professionals identify the type of issue. [2]. The most reliable prostatic cancer marker is PSA, which is employed for population screening, diagnosis, and patient monitoring. There have been some epidemiologic research on the link between diabetes, prostate cancer risk, and PSA, but the conclusions have frequently been conflicting and unclear. [3].

Diabetes mellitus is a complex group of metabolic disorders which is associated with an elevated glucose level in the blood. this could be chronic or severe. It is a heterogeneous group of disease entity in which by several mechanisms hyperglycemia results. Hyperglycemia results from the inability of the body to utilize glucose which may be due to cells resistance to circulating insulin and could also result from an absolute or a relative deficiency in the secretion of insulin [4]. Diabetes mellitus in recent years has posed as a major risk factor to other diseases bringing about several complications such as retinopathy, neuropathy, nephropathy, cancer, coronary artery disease and death. According to numerous studies, diabetic patients have a higher risk of acquiring certain cancers than non-diabetics do, including pancreatic, colon, and liver tumors.

Hyperglycemia is one cause for this elevated risk. However, recent research revealed that men with diabetes had a lower risk of developing prostate cancer [4]. This study is aimed at evaluating diabetes impact on PSA level in relation to their demographic features.

Materials and Methods

Area of Study

This research was conducted among diabetes patients at Bingham University Teaching Hospital in a hospital setting (BHUTH). The tertiary healthcare facility BHUTH is situated in Jos, the state capital of Nigeria's Plateau state.

Study population

The study was carried out among diabetic men attending Bingham University Teaching Hospital. Control subjects were non-diabetic individual in the hospital. The diabetic status of these subjects was confirmed from their clinical folder.

Eligibility criteria

Inclusion criteria

This study included asymptomatic and symptomatic men of 20 years and above with confirmed cases of diabetes mellitus attending diabetic clinic in Bingham University Teaching Hospital, Jos.

Exclusion criteria

The study excluded female diabetic patients. Male subjects below 20 years old attending diabetic clinic at Bingham University Teaching Hospital, Jos. Diabetic patients not registered with the hospital were also not included.

Sample size

The sample size formula as described by Frankline [5] was used to obtain the sample size for this project.

$$n = \frac{(1.96)^2 \times Pexp\ (1-Pexp)}{d^2}$$

Where: n= sample size

p = expected prevalence

d = the desired absolute precision of 5%

P_{exp} = 4.3%

$$n = \frac{(1.96)^2 \times 4.3\% \times (1-4.3\%)}{(5\%)^2}$$

$$n = \frac{3.8416 \times 0.043 \times 0.957}{0.0025}$$

$$n = \frac{0.1580856816}{0.0025}$$

n = 63 subjects

Sampling Method

Subjects were recruited into the study via simple random sampling method using a numbering system described by Fyneface *et al*. [6,7] where participants were to pick numbers ranging from 0-1. All participants who picked "1" were included in the study while those that picked "0" were excluded.

Collection and Processing of Specimens

Blood samples were obtained from the diabetic clinic, the BHUTH's medical outpatient department (MOPD), and the general outpatient department (GOPD).

Venipuncture was used to obtain a random sample of three milliliters (3ml) of venous whole blood from each man's (Diabetic patient) antecubital vein. The venous whole blood was immediately transferred into a plain specimen tube with proper labeling and allowed to coagulate for at least 60 uninterrupted minutes at room temperature.

The blood samples were centrifuged at 2500 rpm for 15 minutes, and using Pasteur's pipettes, the separated supernatant (serum) was placed into additional plain specimen bottles that had been well-labeled.

The separated serum was kept frozen at a temperature between -20°C and -24°C, with the storage location being checked daily until analysis was completed.

Test Principle

The PSA ELISA analysis is a two-site immunoassay in solid phase. The microtiter wells are coated with rabbit anti-PSA, and a different anti-PSA monoclonal antibody that has been tagged with horseradish peroxidase serves as the detecting antibody. The two antibodies "sandwich" the PSA molecules from the standard solution or serum. The coated antibody-antigen-antibody-enzyme complex is formed, and the unbound antibody-enzyme tracers are then washed away. Using a colorimetric reaction, the amount of horseradish peroxidase activity bound in the wells is determined. The proportion of PSA present in the sample is reflected in the color formation's intensity.

Analysis Procedure

The holder was filled with the required number of coated wells. In the appropriate wells, 25µl of the standard, samples, and blanks were injected. Afterward, 100µl of the enzyme conjugate was added to each well, and it was gently stirred for 5 seconds. The mixture was then incubated for 45 minutes at room temperature. The incubated mixture was removed by empting the plate contents into a waste container. With washing buffer (1X), the microtiter wells were rinsed and emptied five times. The wells were quickly brushed over absorbent paper to eliminate any excess water droplets. Each well was then filled with 100µl of TMB solution, which was gently stirred for 5 seconds. The mixture was incubated at room temperature for 15 minutes, the mixture was incubated at room temperature. To each well, 100µl of stop solution was added to halt the reaction and for 30 seconds, the mixture was gently mixed until the blue color completely changed to yellow. Using a microtiter plate reader, the optical density was read at 450nm within 15 minutes.

Statistical analysis

The data obtained were analyzed with **SPSS** (Statistical Package for Social Sciences) and the results were presented in Tables. Mean, standard deviation (SD) and percentages were calculated while T-test and ANOVA was analyzed, *P*-value< .05 was considered significant.

Results

Table 1 shows the demographic features such as age group, gender, settlement, educational level, occupation, knowledge of PCR, family history of diabetes, years of diabetes, and medication of the participants being understudied. The data was presented in percentages.

Table 1: Demographic Features of study participants

Demographic characteristics	Number (%)
Age group	
20-29	0(0.0)
30-39	5(7.9)
40-49	5(7.9)
50-59	25(39.7)
≥60	28(44.4)
Gender	
Male	63(100.0)
Settlement	
Urban	59(93.7)
Rural	4(6.3)
Educational level	
Informal	8(12.7)
Primary	13(20.6)
Secondary	13(20.6)
Tertiary	29(46.0)
Occupation	
Civil servant	8(12.7)
Business	24(38.1)
Artisan	9(14.3)
Retired	13(20.6)
Others	9(14.3)
Knowledge of PCR	
Yes	23(36.5)
No	40(63.5)
Family history of diabetes	
Yes	33(52.4)
No	30(47.6)
Years of diabetes	
1-5	35(55.6)
6-10	20(31.7)
>10	8(12.7)
Medication	
Yes	56(88.9)
No	7(11.1)

Key PCR: prostate cancer

The result presented in table 2 shows the comparison of PSA levels in each demographic parameter among diabetics. The result revealed that there was no significant difference (*P*-value>.05) in the levels of PSA in each of the studied demographic parameters which included, age group, settlement, educational level, occupation, knowledge of PCR, family history of diabetes, years of diabetes and medication.

Table 2: Mean level of prostate specific antigen (PSA) in diabetic men according to demographic characteristics

Demographic characteristics	Mean (ng/ml)	SD	F/t-test	*P*
Age group				
20-29	0.00	.00	1.757	.165
30-39	0.64	.11		
40-49	0.61	.16		
50-59	1.82	.98		
≥60	6.09	2.07		
Settlement				
Urban	3.36	1.06	.637	.525
Rural	6.08	4.49		
Educational level				
Informal	1.30	.24	.612	.610
Primary	5.22	3.85		
Secondary	5.04	2.15		
Tertiary	2.71	1.11		
Occupation				
Civil servant	7.03	6.31	.486	.746
Business	2.59	1.23		
Artisan	2.52	1.34		
Retired	4.14	1.84		
Others	3.03	2.06		
Knowledge of PCR				
Yes	3.13	1.28	.293	.771
No	3.76	1.46		
Family history of diabetes				
Yes	2.61	.98	.931	.355
No	4.54	1.88		
Years of diabetes				
1-5	2.60	.92	.515	.600
6-10	4.88	2.67		
>10	4.21	2.59		
Medication				
Yes	3.65	1.14	.332	.741
No	2.55	1.77		

P-value<0.05

Key PCR: prostate cancer.

The result presented in table 3 shows the comparison of PSA levels in each demographic parameter among non-diabetics. The result shows that there was no significant difference (*P*-value>.05) in PSA levels in each of the studied demographic parameters which included, age group, settlement, occupation, knowledge of PCR, family history of diabetes, years of diabetes

and medication except in education level. A significant difference (*P*-value<.05) was observed in the levels of PSA among different education cadres.

Table 3: Mean level of prostate specific antigen (PSA) in non-diabetic men according to demographic characteristics

Demographic characteristics	Mean (ng/ml)	SD	F/t-test	*P*
Age group				
20-29	.64	.09	2.077	.122
30-39	.78	.12		
40-49	.77	.31		
50-59	1.01	.22		
≥60	1.71	.50		
Settlement				
Urban	1.02	.15	-	-
Educational level				
Informal	.83	.00	4.774	.011
Primary	1.98	.53		
Secondary	.74	.14		
Tertiary	.84	.11		
Occupation				
Civil servant	.76	.19	1.458	.252
Business	1.62	.49		
Artisan	.82	.27		
Retired	1.39	.00		
Others	.78	.08		
Knowledge of PCR				
Yes	.88	.12	.870	.393
No	1.15	.27		

P-value<0.05

Key PCR: prostate cancer

Table 4: Comparison of mean level of prostate specific antigen (PSA) in diabetic and non-diabetic men on demographic basis.

Demographic characteristics	Diabetics PSA (ng/ml)	Non-diabetics PSA (ng/ml)
Age group		
20-29	.00	.64
30-39	.64	.78
40-49	.61	.77
50-59	1.82	1.01
≥60	6.09	1.71
Settlement		
Urban	3.36	1.02
Rural	6.08	
Educational level		
Informal	1.30	.83
Primary	5.22	1.98
Secondary	5.04	.74
Tertiary	2.71	.84
Occupation		
Civil servant	7.03	.76
Business	2.59	1.62
Artisan	2.52	.82
Retired	4.14	1.39
Others	3.03	.78
Knowledge of PCR		
Yes	3.13	.88
No	3.76	1.15

The result presented in table 5 shows the comparison of PSA level between diabetic and non-diabetic subjects. The finding shows that no significant difference was noted in PSA level between diabetics (3.53ng/ml) and non-diabetics (1.02ng/ml), *P*-value=.131.

Table 5: Comparison of mean level of prostate specific antigen (PSA) in diabetic and non-diabetic men.

Subjects	Mean (ng/ml)	SD	t-test	*P*
Diabetic	3.53	1.03	1.524	.131
Non-diabetic	1.02	.15		
Total	2.81	.75		

P-valu<0.05

Discussion

The research was conducted to find the level of prostate specific antigen (PSA) among diabetic men attending Bingham University Teaching Hospital.

Prostate specific antigen screening is a fundamental step in the identification of early prostate cancer, PSA screening is also being used for the monitoring of prostate cancer treatment. This has been of great importance in reducing the growing burden of prostate cancer in developed and developing countries. The result from this study showed increasing pattern of PSA level in men with increasing age, just as documented by American Cancer Society (ACS), [8]. Both patients with diabetes and those without the disease showed the same pattern. The descriptive pattern, however, did not alter considerably. Men's prostate volumes have been seen to rise as they age, and as gland size increases, more PSA is released into the bloodstream. Black men appear to have higher overall PSA concentrations than Caucasian, Chinese, and Japanese counterparts because this growth in prostate size has been more pronounced in blacks than in Caucasians [8,9].

Results from diabetic patients at Bingham University Teaching Hospital revealed that diabetic males had high levels of prostate specific antigen across all demographic factors, compared to non-diabetic men who had low levels across all demographic characteristics. The descriptive rise in PSA level may be due to age. As reported by ACS and Amadi [9] respectively in the previous paragraph, it was noted that PSA level increases with age. Most of the subjects recruited in this study were from 50 years and above (84.1%). This age group would capture more diabetic subjects than the younger age group. It is true that diabetes is now a growing concern in younger adults but the association between diabetes and age is a known fact and a vital health concern in geriatric clinic, therefore, the rise in PSA level in diabetics may be primary due to age factor and not the disease itself.

Generally, there was no significant difference or impact of demography on PSA level in diabetics and non-diabetes except on educational level. Educational level was reported to have key impact of PSA level among non-diabetic subjects. This finding is in consonance with the work of same authors of this current study is an unpublished literature. It was concluded that the more subjects were improved in their level of education, the lesser the PSA value. There was a significant difference in PSA level among various educational status as seen in this current work.

It was discovered from this study that there was no significant difference in the mean PSA level between diabetic and non-diabetic men, based on the work completed and within the range of experimental errors, which was intended to determine whether there is any difference between the serum levels of prostate specific antigen (PSA) in diabetic and non-diabetic men. Men with diabetes had a mean PSA level of 3.53 ng/ml that was greater than those of men without diabetes, who had a mean PSA level of 1.02 ng/ml. According to a theory, men who have just been diagnosed with diabetes have a higher risk of developing prostate cancer than men who

have had diabetes for a long time. Researchers noticed greater insulin and insulin-like growth factor 1 (IGF-1) concentrations in early diabetes and lower testosterone and IGF-1 levels and higher estrogen concentrations in long-term diabetes in the biologic models put forth to explain this link [10], though the result obtained from this work contradicts the work of David *et al.* as the finding from this study showed high level of PSA in men with long-term diabetes and a low level of PSA in men recently diagnosed with diabetes.

Conclusion

This study has revealed that demography and diabetes did not have any profound effect on PSA level among subjects attending Bingham University Teaching Hospital (BHUTH). However, level of education has a key role on PSA level among non-diabetics.

Ethical Approval:

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

Consent

As per international standard or university standard, patients' written consent has been collected and preserved by the author(s).

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