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Relationship between Body Mass Index and Prostate Specific Antigen among Community Men in Port Harcourt, Nigeria

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ABSTRACT

Background: The prevalence of prostate cancer is increasing at a high rate in the Niger Delta region of Nigeria. The role of androgens, age and genetics are established worldwide. Among others, obesity, a consequence of Improvement in quality of life in the oil rich region, which has also been implicated in several conditions like diabetes, hypertension, depression, osteoarthritis and several other malignancies, could be a risk factor. Our aim in this study is to establish a relationship between BMI, an index of obesity and Prostate Specific Antigen (PSA), a marker for prostate cancer.

Materials and Methods: We carried out a community-based observational study in Port Harcourt, Rivers State. The demographic, anthropometric and medical history of men, forty years and above who have lived in the Niger Delta area of Nigeria for over 15 years and who had no prior history of prostate cancer was taken. The BMI and the quantitative PSA of the participants were determined. The corelation of BMI and PSA was established.

Results: A total of 583 respondents participated in the study. Mean age was 60.53 ±7.82. Mean BMI was 24.49 ±3.75. 18% of respondents were underweight, 53.3% were of normal weight, 35.3% were overweight and 7% were obese. The mean PSA was 4.12ng/ml, 84.5% had normal PSA, 15.5% had PSA greater than 4. There was a weak negative correlation between BMI and serum PSA with Pearson correlation of -0.010.

Conclusion: This study shows a negative correlation between BMI and prostate cancer. In view of this inverse relationship between PSA and BMI it may be necessary to reduce the threshold for further evaluations like prostate biopsies in patients with high BMI. Additionally more specific diagnostic tools like ultrasound guidance during prostate biopsy may be helpful.

Keywords: *BMI, Obesity, Prostate-cancer, PSA.*

INTRODUCTION

Body Mass Index (BMI) is an index that uses an individual's weight and height to provide an approximate value for body fat. The National Institute of Health and World Health Organization use BMI to classify a person as under-weight, normal weight, over-weight or obese.[1] The prevalence of obesity is increasing at a high rate. Obesity has been implicated as a risk factor for several conditions like diabetes, hypertension, depression, osteoarthritis and several malignancies.[1-3]

Prostate diseases constitute a significant cause of morbidity and mortality among men above 40 years.[4] Prostate cancer (PCa) and Benign prostate enlargement are common health concerns is this age group and their incidence is expected to increase as life expectancy improves.[5] Prostate cancer is now the most common cancer in Nigerian men.[6,7] and prostate specific antigen (PSA) is the vital tool in the screening, diagnosis and monitoring of patients with prostate cancer.[6,7] The use of PSA for screening of CAP has however been a subject of debate because of the limitations and results of clinical trials; its use is said to lead to over diagnosis in twenty to fifty percent of patients[8, 9,10]

PSA values have been found to be elevated in prostatitis and benign prostatic hyperplasia while some other clinical conditions like diabetes and even consumption of certain drugs have reduced the value[11]. PSA is also affected by factors like trauma from prostate biopsy, digital rectal examination, cycling and transiently by ejaculation [12-14]. These factors, directly or indirectly could cofound the relationship between BMI and PSA[11].

A number of studies have analysed the relationship between PSA and obesity[11, 15-22]. Obesity is said to increase the risk for PCa and is linked to higher grades at biopsy and worse outcomes in patients on treatment,[18,19] has also been said to have an inverse relationship with PSA [11] and no relationship at all. [20-22]

The rising prevalence of prostate cancer in our environment is a concern. A few epidemiological studies have been done here to establish the relationship between prostate cancer and obesity. In this study we determined the relationship between PSA and BMI in apparently normal community men in Rivers State, Nigeria.

MATERIALS AND METHODS

This is a community based prospective observational study. The study area was Rumueme, a densely populated community in Obio-Akpor local government area (LGA) of Rivers state, a major oil and gas producing state in the Niger Delta area of Nigeria. We invited adult males from the age of 40years and above through announcements in churches, mosques, and through various mechanisms of information dissemination. We also employed services of community leaders to reach out to the natives, and other community dwellers who were not regular worshipers. The inclusion criterium was a proof of residence in the Niger Delta area for at least 15 years. The population included people from all walks of life irrespective of their ethnicity or place of origin in Nigeria provided they have resided in the city of Port Harcourt or its neighboring towns in Rivers State for at least 15 years. We chose a community in Obio-Akpor

LGA because that local government hosts a tertiary health institution where we had observed over time high PSA in age matched males. The only exclusion criterion was previous diagnosis of prostate cancer and unwillingness on the part of the individual to join the study.

All males who showed up at the arena for recruitment into the study were selected. The choice of Rumueme community was by random sampling of 17 wards/communities that make up Obio-Akpor LGA of Rivers State.

The study instruments included a pretested questionnaire which was used to interview respondents. It had an introductory part which contained benefits of the study and a main part which had demographic and medical history of the respondent. Trained assistants measured the height (in meters) and weight (in kilogram) of respondents using a stadiometer. The BMI of respondents was calculated using the formular BMI = height $(m)^2$/ weight (kg). After this, sample of the patients' venous blood was obtained by venepuncture for serum PSA. Beckman Coulter Access 2 immunohistochemistry assay kit was used to determine serum PSA of respondents.

Data Analysis was done using SPSS version 25. The researcher was not aware of any biases in this study. Kruskal-Wallis H test and Mann-Whitney test were used for the analysis and test of significance respectively. The equation BMI = height (m^2)/weight (kg) which was used to determine BMI had been validated in previous studies.

RESULTS

A total of 583 respondents participated in the study. The minimum age was 41years and the maximum age was 85years with age range of 44 and mean age of 60.53±7.82 years. Majority of the respondents (84.5%) had normal PSA of 0-4ng/ml. with only 15.6% with PSA greater than 4ng/ml. Majority of participants (53.3%) had normal BMI (18-24.9), while 46% had abnormal BMI (underweight 4.5%, overweight 35.2% and obese 7%). Pearson correlation coefficient for BMI and PSA was -0.010 with p value of 0.822. Pearson correlation coefficient for age and PSA was 0.178 with p value <0.001.

Table 1: Age group distribution

	N	%
Age group		
40-49	52	8.9
50-59	212	36.4
60-69	247	42.4
70-79	69	11.8
80-89	3	0.5
Mean Age (years)	60.53±7.82	

Table 2: Distribution of categories of BMI

BMI		
Underweight (<18.5)	26	4.5
Normal (18.5-24.9)	311	53.3
Overweight (25-29.9)	205	35.2
Obese (30-34.9)	41	7.0
Mean BMI (kg/m^2)	24.49±3.75	

Table 3: PSA range frequency

PSA	**Frequency**	**Percent**
0-4	493	84.5
4-10	59	10.2
>10	31	5.4
Total	**583**	**100.0**

Mean PSA 4.12 ± 11.01 ng/ml

The relationship between PSA and BMI is negative, weak and not statistically significant

Table 4: Correlation of BMI and Age with PSA

		Total PSA
BMI (Kg/m^2)	Pearson Correlation	-0.010
	p-value	0.822
	N	583
Age(years)	Pearson Correlation	0.178
	p-value	<0.001
	N	583

The relationship between PSA and BMI is negative, weak and not statistically significant

DISCUSSION

Prostate cancer is one of the most frequently diagnosed cancers in men and PSA is an important tool in the diagnosis of prostate cancer. [22]

In our study the age range was 40-85 years, most of the participants were in the 60-69 age group with a mean age of 60.53±7.82 (table 1), while age group with the least frequency were those above 80 years (table 1). This is similar to the findings by Torantino et al.[22]

The mean PSA in our study was 4.12 ± 11.01 ng/ml (table 3). This is similar to what was found by Harrison et al [20] in their study Protect trial of treatment for localized cancer nested within the UK. Most of the respondents: 493 (84.5%), had PSA range of 0-4ng/ml while 31(5.4%) had a PSA > 10ng/ml.

The mean BMI from our study was 24.49±3.75 (table 2) and over half of the study population 311 (53.3%) had a normal BMI (table 1). This is in agreement with other studies [20,23].

In our study we found a statistically significant association between PSA and age. There was an increase in PSA with increase in age. Eboreime et al,[24] in their study also found that PSA increased with age

This study recorded a negative Pearson correlation of – 0.010 indicating a slight inverse relationship between PSA and BMI (table 4). In Nigeria Dada et al[25] documented a lower PSA in men with higher BMI. Other authors have also reported similar findings among non-African population. Studies in the united states of America reported a decrease PSA per unit increase in BMI [20,21,26]. This inverse relationship between PSA and BMI has been supported by some theories like the haemodilution theory which suggests that with increase in BMI there is increase in plasma volume. The high plasma dilutes the concentration of PSA.[27] Another theory hinges this negative relationship on the fact that with increased BMI there is increased adipose tissue leading to increase aromatase action and so reduced testosterone. This reduced testosterone leads to reduced growth of the prostate which results in reduced PSA. [28] The relationship between BMI and PSA in this study was however not statistically significant with a p-value of 0.822 and the non- statistical significance may have resulted from the low sample, size as the estimated sample size for this study was 1050.

The fact that PSA may be inversely related to BMI means that men with higher BMI may experience delays in being offered prostate biopsy. This may delay their diagnosis and eventually lead to higher mortalities or presentation with advanced diseases.[20] In view of the documented evidence of the inverse relationship between PSA and BMI it may be necessary to reduce the threshold for further evaluations like prostate biopsies in patients with high BMI

Ethical consideration: Approval for this study was sought and obtained from the ethical committees of the University of Port Harcourt and from the state ministry of health.

Funding: This research was solely funded by the researchers.

Limitations: This was a population base study with estimated sample size of at least 1,050. Reduced sample size may have affected the finding . Because of limited funding only one LGA was sampled; with more funding and support many more LGA could have been studied, thus increasing the scope and the impact of the study.

Conflict of interest.

The authors declare that there was no conflict of interest in this study.

CONCLUSION

BMI was found to have an inverse but weak correlation with PSA in this study.

.RECOMMENDATION

In view of this documented evidence of the inverse relationship between PSA and BMI it may be necessary to reduce the threshold for further evaluations like prostate biopsies in patients with high BMI. Clinicians should therefore be more intentional when evaluating for prostate cancer in obese people. However, there is need to test this further in a larger study cutting across all ethnic groups and races to make a more definitive statement.

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