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Assessment Of Serum Levels Of Prostate Specific Antigen And Prostatic Acid Phosphatase In Commercial Motorcyclist In Nnewi Metropolis

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Abstract: ***This work was designed to evaluate the levels of prostatic acid phosphatase and prostate specific antigen in commercial motorcyclists in Nnewi metropolis. A total of 95subjects were used for this work; 60 commercial motorcyclists (test group) and 35 non- motorcyclists (control group). The subjects were grouped into varying age categories. Prostatic acid phosphatase levels were determined spectrophotometrically, while prostate specific antigen levels were determined by the Enzyme-linked Immunosorbent Assay technique. The result showed that the commercial motorcyclists have significantly higher mean serum PAP (8.75 ± 4.30; P=0.023), TPSA (2.32 ± 0.72; P=0.001), FPSA (2.32 ± 0.72; P=0.028), and BMI (25.79 ± 2.71; P=0.000) respectively when compared to those of the control group in each case. However, due to these significant increases in the levels of TPSA, FPSA and PAP, associated with motorcyclists as they advance in age, it is suggested that commercial motorcyclists should constantly evaluate their PAP and PSA levels as they advance in age and years of experience.***

I. INTRODUCTION

The prostate is a part of the male reproductive organ that helps to make and store seminal fluid in adult men. It is a walnut-sized gland located between the bladder and the penis, just in front of the rectum. The urethra runs through the centre of the prostrate, from the bladder to the penis, letting urine flow out of the body. A typical prostate is about three centimetres (*Aumüller,1979*).The prostate secretes fluid that nourishes and protects sperm. During ejaculation, the prostate squeezes this fluid into the urethra and it's expelled with sperm as semen (Balk *et al*., 2013).

Prostate cancer is the most common male genital cancer among blacks worldwide (Haas *et al.,* 2013). It has

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been described as a public health epidemic. It is a slow growing cancer and the most commonly diagnosed malignancy in males above the age of fifty in the developing world and ranks second among the causes of cancer death in men (Pienta, 2014). Various studies by eminent scholars in Nigeria have shown varying but relatively high incidence rates among Nigerians. A study conducted in Ibadan ranked prostate cancer as the number one cancer in Nigerian males (Ogunbiyi *et al*., 2011). Prostate cancer is rarely seen among male below the age of 40year and although it is one of the most prevalent types of cancer in men. The cancer cells may metastasize from the prostate to other parts of the body, particularly the bones and lymph nodes. Prostate cancer may cause pains, difficulty in urination, problems during sexual intercourse, or erectile dysfunction (Lawani *et al*., 2012). In spite of its high incidence and prevalence, prostate cancer has a relatively slow rate of growth, meaning that it also takes longer than other malignancies to progress from early to advanced disease (Galper *et al*., 2015).

Prostatic acid phosphatase (PAP), a glycoprotein synthesized by the prostate gland, is a member of a diverse group of iso-enzymes, which are capable of hydrolysing phosphate esters in acidic medium. It was first used as a tumor marker. Prostatic-acid phosphatase was a major tumour marker for prostate cancer for more than 50years (Rodrigues *et al*., 2012). However, it is no longer used to screen for or stage prostate cancer. In most instances, serum prostate specific antigen (PSA) is used instead. PAP usefulness is now limited to niche applications. Pre-treatment PAP measurement may add unique, clinically useful prognostic information for predicting recurrence in men who are undergoing radical prostatectomy for clinically localized prostate cancer (Moult *et al*., 2013;Pienta *et al*., 2015). Prostatic acid phosphatase may also be used for following the progression of disease response to therapy in men treated by androgen ablation (Aligbe *et al*., 2011; Valonas *et al*., 2013). However, for both of these applications, PSA provides more information and also should be utilized. The reference values of PAP is </=2.10 ng/ mL. Prostatic acid phosphatase (PAP) levels above the reference range may indicate prostate cancer, but this test should not be regarded as an absolute test for malignancy since other factors like benign prostatic hyperplasia, prostatic infarction, multiple myeloma and manipulation of the prostate gland may result in elevated serum prostatic acid phosphatase concentration (Liong *et al*., 2015).

A rise in PAP levels in patients with known prostate cancer can indicate tumour progression or recurrence (Sperling *et al*., 2011; Taylor *et al*., 2012). However, there is considerably intra-subject biological variability, limiting the usefulness of this test. Thus, PAP measurements provide little additional information beyond that provided by prostate-specific antigen measurements.

Prostate specific antigen (PSA) is a protein produced by cells of the prostate gland. It is the most important, accurate, and clinically useful biochemical marker in the prostate (Balk *et al*., 2013). It is a single chain glycoprotein with molecular weight of 28.4kilodalton. It has 237 amino acid residues and four carbohydrate side chains with linkages at amino acid 45 (Asparagines), 69 (Serine), 70 (Threonine) and 71 (Serine). It was discovered by Hara and his colleagues (2008).Prostate specific antigen can otherwise be called "gamma-seminoprotein" or "kallikrein-3 (KLK3)". It is manufactured by the secretory epithelial cells and drains into the ductal system, where it catalyses the liquefaction of the seminal coagulum after ejaculation.PSA test measures the level of PSA in a man's blood. Serum level of PSA is normally less than 4ng/mL (monoclonal), but varies according to patient age and race; any process that disrupts the normal architecture of the prostate allows diffusion of prostate-specific antigens into the stroma and micro-vasculature (Beaver *et al*., 2015).

Elevated serum prostate specific antigen levels are seen with prostatitis, infarcts, hyperplasia, and transiently after biopsy, but the most clinically important increases is seen with prostatic adenocarcinoma (Hochmeister *et al*., 2012). Cancer produces less prostate specific antigen per cell than benign epithelium, but the greater number of malignant cells and the stromal disruption associated with cancer account for the increased serum prostate specific antigen level (Hara *et al*., 2008). The use of prostate-specific antigen has resulted in an increase in the detection rate of cancer, and it is now advocated for annual routine use in men older than 40years who are at increased risk and in all men older than 50 years. It is a test with high sensitivity and specificity that is rapid, inexpensive, minimally invasive, and acceptable to patients (Hailstorm *et al*., 2009). Five derivatives of serum prostate specific antigen were recently described that may increase the predictive value by accounting for confounding variables such as patient age, prostate volume, and cancer volume: age-specific references, prostate-specific antigen density, prostate specific antigen velocity, prostate specific antigen cancer density, and prostate specific antigen doubling times. Serum prostate specific antigen detects a heterogeneous group of cancers that are clinically important and potentially curable (Catalona *et al*., 2009).

Other prostate cancer markers include the following: Human glandular kallikrein(hk-2), Goteborg screening, etc.

In this study, values obtained from PSA determinations were compared with that of PAP activities. Motorcycling is the major means of transportation in Nnewi metropolis. Commercial motorcyclists are exposed to heat from the engine of the motorcycle and other stress (physical and oxidative) which are among the risk factors of prostate disorders. Prostate cancer may be associated with age, race, family history and stress factors including oxidative and physical stress (Hankey *et al*., 2009). Commercial motorcyclists are exposed to severe stress and heat emissions from the motorcycle engines. Studies have shown relationship between high prostate specific antigen level and prostatic acid phosphatase level as clinically useful biochemical markers of prostate cancer (Antonarakis *et al*., 2012). Therefore, result obtained from this research may be useful in formulating policies in public health. The aim of this work is to assess the serum levels of prostate specific antigens and prostatic acid phosphatase in commercial motorcyclist in Nnewi metropolis, as markers for prostate cancer.

II. MATERIALS AND METHODS

STUDY AREA

The study was carried out in Nnewi metropolis, Anambra state, Nigeria.

RESEARCH DESIGN

A total of 95 subjects participated in this research work. 60 commercial motorcyclists (test group) and 35 non-motorcyclists(control group). A well structured Questionnaires were distributed to obtain the subject's demographics, knowledge, and general dietary habits. The subjects were grouped into four groups as follows: 15- 34years (20 subjects), 35- 44years (29 subjects), 44years and above (11 subjects). Anthropometric parameters were obtained using standard procedures (Kliegman and Berhman, 1996; Paynter and Parkin, 1991). Thereafter, 5ml of blood was collected by vene-puncture from each of the subjects into a plain container. The samples were centrifuged at 3000rpm for 5minutes and the serum collected was refrigerated at -20C, at Nnamdi Azikiwe University Teaching Hospital Chemical Pathology Laboratory, for 2days before analysis. Biochemical parameters (Prostatic acid phosphatase (PAP) and Prostate specific antigen (PSA)) were estimated using colorimetric method (Bias *et al.,* 2015) and ELISA technique (Stamey *et al*., 2012) respectively.

INCLUSION CRITERIA AND EXCLUSION CRITERIA

Commercial motorcyclists in Nnewi metropolis with no known prostate disorders aged 15years and above were recruited for the study whereas subjects below 15years and those with known prostate disorders were excluded from the study.

ETHICAL CONSIDERATION

Ethical approval for this research was obtained from the Ethics committee of Nnamdi Azikiwe University, Nnewi campus. Also, the informed consent of the participants were sought and obtained.

STATISTICAL ANALYSIS

Data collected were subjected to statistical analysis using the Independent sample T-test and correlation method. The results obtained from the analysis are stated below. Values were deemed significant if P<0.05.

III. RESULTS

Commercial motorcyclists showed significantly higher mean serum PAP, TPSA, FPSA, and BMI, as showed in table, when compared to those of the control group (P<0.05).

However, there was no significant decrease in the mean for serum Total ACP of commercial motorcyclists when compared to those of the control subjects (P>0.05) (See table 1).

	COMMERCIAL BIKE RIDERS N=60 (MEAN ± SD)	CONTROL SUBJECTS N=35 (MEAN ± SD)	T-VALUE	P-VALUE
Total ACP (ng/ml)	18.56± 3.46	19.76± 2.50	-1.797	0.644
PAP (ng/ml)	8.75 ± 4.30	10.63 ± 2.81	-2.319	0.023*
TPSA (ng/ml)	2.32 ± 0.72	1.00± 0.65	3.297	0.001*
FPSA (ng/ml)	0.59 ± 0.45	0.38 ± 0.23	2.233	0.028*
BMI (kg/m^2)	25.79 ± 2.71	21.37 ± 2.24	8.133	0.000*

** Significant at p<0.05*

Table 1: Comparisons of serum Total ACP, PAP, TPSA, FPSA and BMI levels between commercial motorcyclists and control subjects

There were significant positive correlations in serum Total ACP with years of experience, Total ACP with age, TPSA with years of experience, TPSA with age, FPSA with years of experience, FPSA with age, respectively in commercial motorcyclists. (P<0.05) in each case. There were also significant positive correlations in serum PAP level of commercial motorcyclists with their years of experience, and with their age respectively (P<0.05) in each case (See table 2).

	YEARS OF EXPERIENCE		AGE	
PARAMETERS	r-value	p- value	r-value	p-value
Total ACP (ng/ml)	0.419	0.001*	0.423	0.001*
TPSA (ng/ml)	0.480	0.000*	0.408	0.001*
PAP (ng/ml)	0.820	0.000*	0.880	0.000*
FPSA (ng/ml)	0.297	0.021*	0.308	0.018*

** Significant at p<0.05*

Table 2: Correlation of serum Total ACP, TPSA, PAP and FPSA levels with years of experience and age in commercial motorcyclists (N=60)

Furthermore, there was a positive correlation in serum Total ACP with TPSA in commercial motorcyclists, but the correlation was not significant. (P>0.05). Hence, there were significant positive correlations between serums PAP with TPSA, serum PAP with FPSA, respectively in commercial motorcyclists. (P<0.05) in each case (See table 3).

Correlations	Correlation coefficient	P-value
Total ACP vs TPSA	-0.038	0.712
PAP vs TPSA	0.297	0.003*
PAP vs FPSA	0.541	0.000*

** Significant at p<0.05*

Table 3: Correlation of serum Total ACP, PAP, TPSA and FPSA levels in commercial motorcyclists (N=60)

In addition, there were significant increases of Total ACP with different years of experience in commercial motorcyclists. Total ACP levels increases significantly with years of experience between 0- 7 and 16- 23 years of experience, 0-7 and 24years of experience and above respectively. (P<0.05) in each case. (See table 4).

Hence, there were no significant increase of Total ACP in those between 0- 7 and 8- 15years of experience, 8- 15 and 16- 23years of experience, 8-15 and 24years of experience and above, 16- 23 and 24years of experience and above, respectively. (P>0.05) in each case. (See table 4).

There were significant increase of PAP levels in those between 0- 7 and 8- 15years of experience, 0- 7 and 16- 23years of experience, 0-7 and 24years of experience and above, 8- 15 and 16- 23years of experience, respectively. However, though there were increases in serum PAP levels but the increase were not significant in those between 8- 15 and 24years of experience and above, 16- 23 and 24years of experience and above. (P>0.05) in each case. (See table 4).

TPSA levels were significantly increased in those between 0- 7 and 8- 15years of experience, 0- 7 and 16- 23years of experience, 0-7 and 24years of experience and above, 8- 15 and 16- 23years of experience, 8- 15 and 24years of experience and above, respectively. (P<0.05) in each case. (See table 4).

FPSA levels also increased significantly in those between 0- 7 and 8- 15years of experience, 0- 7 and 16- 23years of experience, 0-7 and 24years of experience and above, 8- 15 and 16- 23years of experience, 8- 15 and 24years of experience and above, respectively. (P<0.05) in each case. (See table 4).

However, there were no significant increase in the TPSA and FPSA levels of those between 16- 23 and 24years of experience and above. (P>0.05) in each case. (See table 4).

There was also no significant increase in BMI when compared with the different years of experience in commercial motorcyclists. (P>0.05). (See table 4).

More so, the mean serum Total ACP levels increased significantly when compared among the age groups of those between 15- 34 and 45years and above, 35-44 and 45years and above, in commercial motorcyclists. (P<0.05) in each case. (See table 4).

	Total ACP	PAP	TPSA	FPSA	BMI
A 0-7 yrs N=29	17.76± 4.27	5.16± 2.73	1.74 ± 0.40	0.28 ± 0.23	25.50 ± 2.84
B 8-15 yrs N=23	18.46± 2.01	11.45± 2.35	2.74 ± 0.48	0.77 ± 0.40	25.78 ± 2.73
C 16-23 yrs N=6	21.19± 0.71	13.91± 0.45	3.17 ± 0.27	1.17 ± 0.26	26.50 ± 2.50
D 24 yrs and above N=2	23.26± 0.82	14.15± 0.07	3.50 ± 0.14	1.30 ± 0.14	27.85 ± 0.78
P value	0.029*	0.000*	0.000*	0.000*	0.607
F value	3.238	42.688	39.518	23.003	0.617
A vs B p-value	0.449	0.000*	0.000*	0.000*	0.718
A vs C p-value	0.023*	0.000*	0.000*	0.000*	0.420
A vs D p-value	0.026*	0.000*	0.000*	0.000*	0.246
B vs C p-value	0.075	0.032*	0.031*	0.008*	0.568
B vs D p-value	0.052	0.135	0.017*	0.025*	0.310
C vs D p-value	0.442	0.902	0.336	0.601	0.549

*Significant at P< 0.05; *A = 0 – 7 years; B = 8 – 15 years; C = 16 – 23 years; D = 24 years and above.*

Table 4: Comparison of serum Total ACP, PAP, TPSA, FPSA and BMI in commercial motorcyclists with their different years of experience

There was no significant increase in the mean of serum Total ACP levels when compared in those between 15-34 and 35- 44years. (P>0.05). (See table 5). Also, there were significant increases in the mean of serum PAP, TPSA, FPSA when compared among the age groups of those between 15-34 and 35- 44years (P=0.000), 15- 34 and 45years and above, 35-44 and 45years and above, respectively. (P<0.05) in each case. Hence, there was no significant increase in BMI when compared among the different age groups in commercial motorcyclists. (P>0.05) (See table 5).

	Total ACP Mean ±SD	PAP Mean ±SD	TPSA Mean ±SD	FPSA Mean ±SD	BMI Mean ±SD
A 15- 34yrs N=20	17.70± 4.97	3.66± 1.33	1.53 ± 0.22	0.20± 0.23	25.05± 2.73
B 35-44yrs N=29	18.21± 2.13	10.26± 2.43	2.50 ± 0.41	0.62± 0.32	26.43± 2.43
C 45yrs and above N=11	20.99± 1.61	14.01± 0.58	3.32 ± 0.26	1.23± 0.25	25.42± 3.24
P value	0.028*	0.000*	0.000*	0.000*	0.194
F value	3.800	125.632	110.090	47.661	1.690
A vs B P value	0.594	0.000*	0.000*	0.000*	0.082
A vs C P value	0.010*	0.000*	0.000*	0.000*	0.716
B vs C P value	0.021*	0.000*	0.000*	0.000*	0.292

Significant at P< 0.05; A = 15 – 34 years; B = 35 – 44 years; C = 45 years and above.

Table 5: Comparison of Total ACP, PAP, TPSA, FPSA and BMI amongst age groups in commercial motorcyclists

The result showed that there were no significant correlations between BMI and TPSA, BMI and FPSA, BMI and PAP, BMI and Total ACP, in commercial motorcyclists. (P>0.05) in each case. (See table 6).

Correlations	Correlation coefficient	P-value
BMIvs TPSA	0.179	0.170
BMI vs FPSA	0.119	0.367
BMI vs PAP	0.157	0.231
BMI vs Total ACP	-0.031	0.817

Significant at P< 0.05

Table 4.6: Correlation of BMI with TPSA, FPSA, PAP and Total ACP in commercial motorcyclists (N=60)

Also, there were no significant increase in Total ACP, PAP, TPSA and FPSA levels when compared among the normal, overweight and obese commercial motorcyclists. (P>0.05) in each case. (See table 7).

	Total ACP Mean ±SD	PAP Mean ±SD	TPSA Mean ±SD	FPSA Mean ±SD
H 18.5-24.9 N=22	18.66± 4.80	7.75± 4.85	2.16 ±0.72	0.50 ± 0.45
I 25.0-29.9 N=36	18.59± 2.48	9.52± 3.90	2.47 ±0.70	0.66 ± 0.45
J 30.0-34.9 N=2	16.91± 0.67	5.91± 2.69	1.60 ± 0.57	0.25 ± 0.20

P value	0.795	0.203	0.098	0.229
F value	0.231	1.638	2.418	1.511
H vs I P value	0.942	0.131	0.108	0.182
H vs J P value	0.503	0.560	0.097	0.453
I vs J P value	0.513	0.248	0.095	0.208

**Significant at P< 0.05; H = 18.5 – 24.9 (Normal); I = 25. 0 – 29.9 (Over weight); J = 30.0 – 34.9 (Obese).*

Table 7: Comparative analysis of Total ACP, PAP, TPSA and FPSA amongst normal, overweight and obese commercial motorcyclists

Finally, 57% of commercial motorcyclists reported to have experienced pains in the bones of their pelvis, spine and ribs. 20.4% reported symptoms of increased urination at night, 16.1% reported to experience frequent urination, 2.2% reported painful urination and 1.1% reported difficulty achieving erection. Only 3.2% reported not having any symptom. (See figure 1).

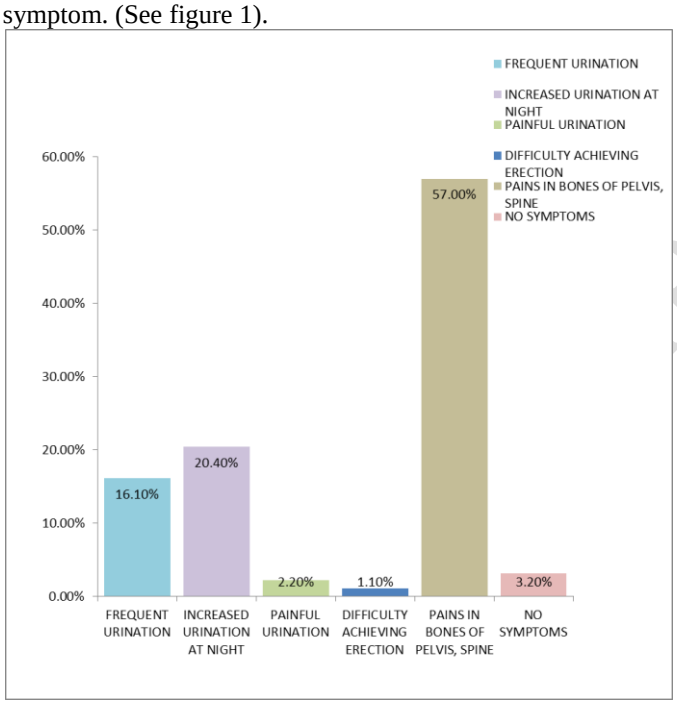

Figure 1: Bar chart representing the percentages of symptoms reported by commercial motorcyclists

IV. DISCUSSION

The present study showed that there are significant difference in serum PAP, TPSA, FPSA and BMI levels of commercial motorcyclists when compared with the corresponding values in the control subjects. Total ACP also increase among commercial motorcyclists. This finding agrees with the work of Carls *et al.*, (2008).The authors reported that physical stress as a result of occupational exposures can lead to increased levels of Total ACP, PAP, and total and free PSA respectively. Sass-Kortsak *et al.*, (2007), also reported a positive association between the highest category of workplace physical activity and the levels of PAP, FPSA and TPSA. Catalona *et al.*, (2009), reported that increased PAP, due to heat generation at the waist region leads to a resultant increase in the Total ACP in the body. Study showed significant correlations between PAP with TPSA, and PAP with FPSA. Similar report by Shannon, reported that obesity and elevated blood levels of testosterone may increase the risk of prostate cancer by increasing their markers. In contrast, Hyeon *et al*., (2014) documented that mean serum free PSA was significantly decreased in physical activity (both occupational and recreational). Yupeng *et al.*, (2011) have shown that there was an inverse association between physical activity and risks of prostate cancer.

More so, the study showed that the increased Total ACP, PAP, TPSA and FPSA increases significantly with the age and years of experience in commercial motorcyclists. These increase in Total ACP, PAP, TPSA and FPSA, could be as a result of long accumulation of smoke, long term generation of heat in the waist region, vibrations, etc. These were in consonance with the findings of Hankey *et al.*, (2009). He reported that prostate cancer was very uncommon in men younger than 45years, but becomes more common with advancing age, as a result of increase in the Total ACP and TPSA encountered during old age. Manafa *et al.*, (2014), in a related study, had reported that PSA levels were significantly increased due to oxidative stress encountered by smokers. Ravi *et al*., (2009), in a related study said that the human body can tolerate certain levels of vibrational energy but starts to deteriorate and can cause long term damage and disruption of the normal processes of the body. Furthermore, Kotwal *et al.*, (2012), reported that PAP and PSA screening rates were higher for men with higher perceived stress, as experienced by the motorcyclists. However, other studies documented a negative association existing between prostate cancer risks and the highest category of workplace physical activity (Lagiou *et al*., 2008; Strom *et al.*, 2008; Krishnadasan *et al.*, 2008; Bairati *et al.*, 2000). Finally, in the present study, symptoms such as pelvis and spine bone pains, increased and frequent urination, painful urination etc were observed to be associated with motorcycling. They were in consonance with the works of Miller *et al*., (2013). The authors reported nocturia, frequent urination and body pains as signs of early prostate disorders.

V. CONCLUSION

On the basis of the findings, due to the significant increase in the levels of serum Total ACP, TPSA, FPSA and PAP in commercial motorcyclists, as they advance in age and years of experience, motorcycling therefore can be said to be one of the risk factors of prostate cancer, since it causes increase in the levels of prostate cancer markers.

VI. RECOMMENDATION

From the findings, we recommend constant evaluation of PSA and PAP levels especially among commercial motorcyclists as they advance in age and years of experience. However, health workers and government agencies should

create awareness on the association between physical stress and levels of prostate cancer antigens.

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