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The Lipidosis Profiling and C-Reactive Protein Evaluated in Patients with Prostate Cancer Attending Madonna University Teaching Hospital in Elele

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Abstract

One prevalent malignant tumor of the male prostate epithelium is called prostate cancer (PCa). The purpose of this study is to assess the C-reactive protein (CRP) and lipid profile of patients with PCa at Madonna University Teaching Hospital (MUTH), Elele. For the study, 50 hospital patients were enlisted. 20 of them were control patients, meaning they were not PCa patients, and the remaining 30 were patients with PCa and ranged in age from 25–65. All those engaged provided their informed permission and ethical clearance properly. Venipuncture was used to get blood samples. Enzyme-linked immunosorbent assay (ELISA) was used to analyze CRP, while total cholesterol (TCH), triglycerides (TG), high-density lipoprotein (HDL), and low-density lipoprotein (LDL) were measured using an enzymatic spectrophotometric approach. Data obtained from this study was analyzed using Statistical Package for Social Sciences (SPSS) version 21 for Windows 7 and one-way analysis of variance (ANOVA), which were used to compare the means. The results were expressed as mean ± SD and values were considered significant at $p < 0.05$ and non-significant at $p > 0.05$. Results from this study showed a significant difference ($p < 0.05$) in the mean values of the following: TCH levels in PCa patients (6.39 ± 0.90 mmol/L) when compared to the control group (4.10 ± 0.50 mmol/L), TG levels in PCa patients (1.84 ± 0.27mmol/L) when compared with the control group (1.26 ± 0.24 mmol/L), HDL levels in PCa patients (0.92 ± 0.10 mmol/L) when compared with the control group (1.02 ± 0.11 mmol/L), LDL levels in PCa patients (4.45 ± 1.00 mmol/L) when compared with the control group (2.33 ± 0.38 mmol/L) and CRP levels in PCa patients (4.48 ± 0.77 mg/L) when compared with the control group (3.44 ± 0.80 mg/L). This probably indicates that the PCa group developed biochemical alteration in lipid profile and CRP parameters within an increased period of time.

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Abbreviations: PCa: prostate cancer; CRP: C-reactive protein; MUTH: Madonna University Teaching Hospital; SPSS: Statistical Package for Social Sciences; TCH: total cholesterol; TG: triglycerides; HDL: high-density lipoprotein; LDL: low-density lipoprotein; ANOVA: one-way analysis of variance; SD: standard deviations

Introduction

Prostate cancer (PCa) is the most common cause of male cancer-related deaths and the most common male non-cutaneous malignancy in the Western world [1]. It is a complex illness with a range of underlying causes and risk factors. In men, the prostate is a little gland situated beneath the bladder. The seminal fluid that nourishes and transports sperm is produced by this particular component of the male reproductive system. Uncontrollably growing prostate cells lead to cancer. Male and female PCa are both possible [2].

Lipids, which include different fatty acids, cholesterol, and triglycerides (TG), are vital parts of cell membranes and have roles in a number of biological processes. PCa has been linked to abnormal lipid metabolism, as with other malignancies. Cancer patients have been shown to have altered lipid profiles, including higher levels of TG, total cholesterol (TCH), low-density lipoprotein (LDL), and lower levels of high-density lipoprotein (HDL). These changes in lipid metabolism may be involved in the angiogenesis, metastasis, and development of tumors. Lipid molecules can also influence the expression of genes linked to the advancement of cancer and function as signaling molecules [3].

In addition to lipid metabolism, chronic inflammation has emerged as a critical factor in PCa development and progression. Chronic inflammation can lead to the production of various inflammatory mediators, including cytokines, chemokines, and acute-phase reactants such as C-reactive protein (CRP). CRP, a protein synthesized by the liver in response to inflammation, has been extensively studied as a biomarker of inflammation and disease activity. Elevated CRP levels have been reported in various cancers, including PCa, and have been associated with poor prognosis and aggressive tumor characteristics [4].

Given the potential links between lipid metabolism, inflammation, and PCa, studying the pattern of lipid profile and CRP levels in PCa patients is crucial. Understanding the alterations in lipid metabolism and inflammation markers in PCa can provide valuable insights into the disease's underlying mechanisms and help identify potential diagnostic and prognostic markers. Furthermore, targeting lipid metabolism and inflammation pathways may offer new therapeutic strategies for the management of PCa.

PCa is a complex disease with multiple risk factors and underlying mechanisms. Alterations in lipid metabolism and chronic inflammation have been implicated in the development and progression of cancer. However, there is a need to investigate the specific pattern of lipid profile and CRP levels in PCa patients. Hence the need for this study.

There is substantial clinical significance in comprehending the pattern of lipid profile and CRP levels in individuals with PCa. PCa is a common condition for which early identification is essential to successful therapy. Clinicians can aid in the early detection and treatment of PCa by identifying particular lipid profile abnormalities and high CRP levels linked to the disease. These indicators can serve as helpful diagnostic and prognostic tools.

The identification of possible biomarkers for PCa diagnosis, prognosis, and treatment will be aided by this research. In the end, it might result in the creation of tailored treatment plans for men with PCa, enhancing their prognosis and quality of life.

Materials and Methods

Study area

This study was carried out in Madonna University Teaching Hospital (MUTH), Elele, Rivers State, Nigeria, between the periods of May and August 2023. Elele Town is located in the southeastern part of Nigeria. It is located in latitude 5° 27° - 5° and longititude 6° 55 -7° 85E. The climate of the area is tropical, with a mean daily temperature of 29°C for most of the year. The annual rainfall in this region is between 217 and 240 cm. There are other towns and villages that surround Elele town, including Isiokpo town, Omagwa, Ahoda, Omoku, Owerri town and others.

Sample size calculation

The incidence rate of PCa patients attending Madonna University Teaching Hospital (MUTH) is 7.4 cases, making the prevalence rate a total of 0.74%. Using the formula below, the sample size was calculated using Leslie Kish's formula.

$N = Z^2 \times p\ (1 - p) / d^2$

Where;

N = Minimum sample size
d = desired level of significance (0.05)
Z = confidence interval (1.96)
p = prevalence rate or proportion of occurrence = 0.74%

Therefore

$N = 3.8416 \times 0.74\ (1 - 0.74) / 0.0025$
N = 50 samples.

Inclusion and exclusion criteria

- Inclusion criteria

Subjects included in the study were PCa patients attending Madonna University Teaching Hospital (MUTH).

- Exclusion criteria

Subjects excluded from the study were non- PCa patients attending Madonna University Teaching Hospital (MUTH).

Ethical approval/ consideration

Participation was voluntary. Informed and oral consents were obtained from the subjects, and confidentiality was assured to them. Ethical approval was obtained from the hospital management. The study was carried out according to the Good Clinical Practice Guidelines of the modified Helsinki Declaration.

Sample collection and processing

A detailed family and medical history were taken. Using a sterile needle and syringe, a blood sample (5 ml) was collected from each subject by venipuncture from the antecubital vein and dispensed into a plain container and labeled for proper identification. The blood sample in the sterile plain containers was allowed to clot for about 45 min. Then, using an applicator stick, the clotted blood was dislodged and centrifuged at 12000 rpm for 5 min. The serum obtained was carefully picked using an automatic micropipette and transferred into another plain specimen container, and tightly screwed. Then, it was deep frozen at -20°C until analysis was done for the samples that could not be analyzed immediately.

Laboratory assays

- Serum TCH was determined by enzymatic method [5]
- Determination of HDL by Friedewald et al. [6]
- While TG was determined by Abel et al. [7]
- Determination of LDL by Friedewald et al. [6]
- Determination of CRP concentration (quantitative) method

Statistical analysis

Data analysis was conducted using Statistical Package for Social Sciences (SPSS) version 21 for Windows 7. The results were expressed as mean ± SD. Data obtained from this study were analyzed using an independent sample t-test and one-way analysis of variance (ANOVA), which were used to compare means, and values were considered significant at $p < 0.05$ and non-significant at $p > 0.05$.

Results

The research results revealed significant differences in lipid profiles and CRP levels between PCa patients and the control group (Table 1). TCH (mmol/L) levels in PCa patients were found to be markedly elevated at 6.39 ± 0.90, compared to the control group's level of 4.10 ± 0.50 ($F = 104.051$, $p < 0.05$). TG (mmol/L) also showed a notable increase in PCa patients, with a mean value of 1.84 ± 0.27, whereas the control group had a mean value of 1.26 ± 0.24 ($F = 59.427$, $p < 0.05$).

Furthermore, HDL (mmol/L) demonstrated a significant reduction in PCa patients, with levels measuring 0.92 ± 0.10, while the control group had HDL levels of 1.02 ± 0.11 ($F = 9.954$, $p < 0.05$). Conversely, LDL (mmol/L) showed a substantial increase in PCa patients, with a mean value of 4.45 ± 1.00, compared to the control group's mean value of 2.33 ± 0.38 ($F = 80.703$, $p < 0.05$).

Moreover, CRP (mg/L) levels were significantly higher in PCa patients, measuring 4.48 ± 0.77, whereas the control group had CRP levels of 3.44 ± 0.80 ($F = 21.119$, $p < 0.05$).

Parameters	Prostate cancer	Control	F	P-value
	Mean ± SD			
Total cholesterol (mmol/L)	6.39 ± 0.90	4.10 ± 0.50	104.051	0.000*
Triglycerides (mmol/L)	1.84 ± 0.27	1.26 ± 0.24	59.427	0.000*
High-density lipoprotein (mmol/L)	0.92 ± 0.10	1.02 ± 0.11	9.954	0.003*
Low-density lipoprotein (mmol/L)	4.45 ± 1.00	2.33 ± 0.38	80.703	0.000*
C-reactive protein (mg/L)	4.48 ± 0.77	3.44 ± 0.80	21.119	0.000*

Table 1: Lipid profile and C-reactive protein concentrations in prostate cancer patients and healthy individuals (control). Significant at $p < 0.05^*$; Non-significant at $p > 0.05^*$.

The table presents the lipid profile and CRP concentrations among different age groups (Table 2). The age groups include individuals aged 25–35, 36–46, 47–57, and 58 and above. For each age group, the table shows the mean values of TCH, TG, HDL, LDL, and CRP, along with their corresponding standard deviations (SD).

Statistical analysis using ANOVA revealed significant differences ($p < 0.05$) in lipid profile and CRP concentrations among the various age groups.

Post-hoc testing was conducted for multiple comparisons to identify specific differences between age groups. The results indicate that the differences in TCH, TG, LDL, and CRP levels were significant between all age groups ($p < 0.05$). Additionally, the HDL levels showed significant differences between the age groups of 25–35 and 58 and above ($p < 0.05$).

Age group	TCH (mmol/L)	TG (mmol/L)	HDL (mmol/L)	LDL (mmol/L)	CRP (mg/L)
	Mean ± SD				
25–35	4.13 ± 0.50	1.25 ± 0.26	1.04 ± 0.11	2.34 ± 0.41	3.34 ± 0.81
36–46	3.96 ± 0.60	1.31 ± 0.16	0.92 ± 0.06	2.24 ± 0.25	4.01 ± 0.44
47–57	6.39 ± 1.11	1.82 ± 0.30	0.94 ± 0.10	4.51 ± 1.11	4.40 ± 0.79
58 and above	6.39 ± 0.72	1.86 ± 0.24	0.91 ± 0.09	4.40 ± 0.92	4.56 ± 0.78
F	33.372	19.182	4.648	25.945	7.789
P	0.000*	0.000*	0.006*	0.000*	0.000*

Table 2: Lipid profile and C-reactive protein concentrations among various age groups. Significant at $p < 0.05^*$; Non-significant at $p > 0.05^*$. Key: TCH = total cholesterol; TG = triglyceride; HDL = high-density lipoprotein; LDL = low-density lipoprotein; CRP = C-reactive protein.

Discussion

The present research evaluated the lipid profile and CRP level in some PCa patients and healthy volunteer male subjects attending Madonna University Teaching Hospital (MUTH) to compare them.

The table revealed significant differences in lipid profiles and CRP levels between PCa patients and the control group (Table 1). TCH (mmol/L) levels in PCa patients were found to be markedly elevated at 6.39 ± 0.90, compared to the control group's level of 4.10 ± 0.50 ($F = 104.051$, $p < 0.05$). TG (mmol/L) also showed a notable increase in PCa patients, with a mean value of 1.84 ± 0.27, whereas the control group had a mean value of 1.26 ± 0.24 ($F = 59.427$, $p < 0.05$).

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Moreover, CRP (mg/L) levels were significantly higher in PCa patients, measuring 4.48 ± 0.77, whereas the control group had CRP levels of 3.44 ± 0.80 ($F = 21.119$, $p < 0.05$).

The table presents the lipid profile and CRP concentrations among different age groups (Table 2). The age groups include individuals aged 25–35, 36–46, 47–57, and 58 and above. For each age group, the table shows the mean values of TCH, TG, HDL, LDL, and CRP, along with their corresponding standard deviations (SD).

Statistical analysis using ANOVA revealed significant differences ($p < 0.05$) in lipid profile and CRP concentrations among the various age groups.

Post-hoc testing was conducted for multiple comparisons to identify specific differences between age groups. The results indicate that the differences in TCH, TG, LDL, and CRP levels were significant between all age groups ($p < 0.05$). Additionally, the HDL levels showed significant differences between the age groups of 25–35 and 58 and above ($p < 0.05$).

The result of this study agrees with that of the study of lipid profiles on PCa patients conducted by Ohira et al. [8]. The result of this study correlates with that of some other previous studies [9–12]. Their research conducted on CRP and lipid profile levels in PCa showed a significant increase in the test subjects when compared to the control. Hence, patients with high CRP levels had an increased risk of PCa. This concludes that PCa patients were at risk for developing biochemical alteration in lipid profile and CRP parameters within an increased period of time [13, 14].

Conclusion

In the present study, we observed significant differences in the mean values of TCH, TG, HDL, LDL, and CRP levels between PCa patients when compared with the mean values of TCH, TG, HDL, LDL, and CRP levels in control

subjects respectively. This suggests that lipid profile parameters have a connection with PCa, and CRP may be used as one of the indicators of high risk of PCa.

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