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# Relationship between hematological, inflammatory and lipid profile in newly diagnosed hypertensive patient in Ogbomosho, Southwest, Nigeria

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## Abstract

**Introduction:** Hypertension is a multifaceted cardiovascular condition and one of the leading causes of morbidity and mortality globally. Emerging evidence highlights the interconnected roles of hematological, inflammatory, and biochemical parameters in the pathophysiology of hypertension. Despite the abundance of global data, the relationships between these parameters may vary across populations due to differences in genetic predisposition, environmental exposures, lifestyle factors, and healthcare access. In view of the above background, we investigated the relationship between those parameters among the inhabitants of Ogbomosho, in Oyo state, Nigeria.

**Methodology:** A hospital based cross-sectional study was carried out at LAUTECH Teaching Hospital, Ogbomosho between May to December, 2024. A total of 160 newly diagnosed hypertensive (NDHTN) and 80 apparently healthy non-hypertensive individuals were recruited for the study, their socio-demographic and clinical data were gathered using questionnaire. About 7 mL of blood were divided into EDTA, citrated and plain specimen bottles. Standard laboratory techniques were appropriately adopted for the estimation of various parameters. Continuous and categorical data were expressed in mean ± SD and percentage respectively, and compared using Student's t-test and Fisher exact test respectively. SPSS version 26 was used for the statistical analysis.

**Results:** Significantly elevation were observed in white blood cells count, C-reactive protein (CRP), interleukine-6 and tissue necrosis factor ($P < 0.05$) in NDHTHN. CRP was elevated in about 95% of NDHTN, and it has sensitivity, specificity and positive predictive value of 73%, 75% and 95% respectively in predicting hypertension.

**Conclusion:** This study reinforces the well-established links between hypertension and factors like age, obesity, and gender. Also, the lack of significant differences in some parameters between two studied groups suggests that these abnormalities may not manifest in newly diagnosed cases or may require prolonged exposure to elevated blood pressure to become evident. These findings highlight the need for longitudinal studies to assess the progression of these changes in hypertensive patients over time.

**Keywords:** Hypertension; CRP; Hematology; Inflammation; LAUTECH

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## 1. Introduction

Hypertension, commonly known as high blood pressure, is a multifaceted cardiovascular condition and one of the leading causes of morbidity and mortality globally. According to the World Health Organization (WHO), hypertension affects over 1.28 billion adults aged 30–79 worldwide, with a significant proportion living in low- and middle-income countries where awareness, treatment, and control rates are often suboptimal [1]. The disease is often referred to as a "silent killer" because it is frequently asymptomatic in its early stages, yet it exerts substantial strain on the cardiovascular system, eventually leading to severe complications such as stroke, myocardial infarction, kidney disease, and heart failure [2]. Early detection and management are therefore critical to reducing the burden of this disease.

Emerging evidence highlights the interconnected roles of hematological, inflammatory, and biochemical parameters in the pathophysiology of hypertension [3, 4]. Hematological parameters, such as red blood cell indices, platelet counts, and hematocrit levels, have been linked to blood viscosity and vascular resistance, both of which are crucial in blood pressure regulation [5]. Similarly, inflammatory markers like C-reactive protein (CRP) and interleukins are implicated in endothelial dysfunction and vascular remodeling, which are hallmarks of hypertension progression [6]. Biochemical parameters, including lipid profiles and fasting blood glucose levels, offer insights into metabolic derangements and end-organ damage that often accompany hypertension [7].

Despite the abundance of global data, the relationships between these parameters may vary across populations due to differences in genetic predisposition, environmental exposures, lifestyle factors, and healthcare access. In Nigeria, hypertension prevalence is increasing, with rural and urban populations showing distinctive risk patterns [8]. Investigating newly diagnosed hypertensive patients in Ogbomosho, a semi-urban area in southwest Nigeria, presents a unique opportunity to understand the interplay of hematological, inflammatory, and biochemical factors within this population. Such findings could bridge existing knowledge gaps, particularly for resource-limited settings, and contribute to the development of targeted diagnostic and management strategies for hypertension.

## 2. Materials and methods

### 2.1. Study area and design

A comparative cross-sectional study was conducted at cardiovascular clinic of Ladoke Akitola University of Technology, Ogbomosho, Oyo State, Nigeria. Ogbomosho is located on longitude 8.5373$^{o}$N and latitude 4.5444$^{o}$ E, in Southwest, Nigeria. This study was conducted between May to December, 2024

### 2.2. Data collection

Socio-demographic data, laboratory tests and anthropometric data were obtained for further analysis. Socio-demographic data included age, height, weight and body mass index (BMI). Laboratory tests included hematological parameters, clotting profile, fibrinolytic profile, inflammatory biomarkers and lipid profile.

### 2.3. Inclusion/ exclusion criteria

Participants in this study include newly diagnosed systemic hypertensive patients with systolic or diastolic blood pressure of ≥ 140 or ≥ 90 mmHg respectively. Both male and female from age 18 to 65 years, without prior antihypertensive treatment and willingness to participate. Individual with pre-existing hematological and coagulation disorders or other major medical conditions affecting hemostasis were excluded from the study. Those below the age of 18 or above 65 years of age, those who were unwilling to provide informed consent for study participation, individuals with history of chronic illnesses like diabetes mellitus, kidney disease, cardiac disease, human immunodeficiency virus (HIV), hepatitis, or critically ill were as well excluded. Pregnancy and lactating women and those with malignancy were also excluded.

### 2.4. Ethical approval

Ethical approval was obtained from the ethical review committee of LAUTECH Teaching Hospital Ogbomosho with reference number LTH/OGB/EC/2024/513.

### 2.5. Statistical analysis

Statistical analysis was carried out using the IBM SPSS version 20 for window software (SPSS Inc. Chicago, IL USA). Quantitative variables are presented as mean ± SEM and qualitative variables as percent. P-values < 0.05 were

considered significant. Descriptive analysis, independent sample T' test and Chi-square test was used for the comparison of data and inferential statistics. Logistic regression was used to assess the independent effects of hypertension on hematological, inflammatory biomarkers and clotting profile alterations, controlling for potential confounding factors.

## 3. Results

### 3.1. Socio-demographics data

The demographic and clinical characteristics of enrolled participants were presented in Table 1. A total of 160 newly diagnosed hypertensive patients (NDHTN) (n =160) and 80 apparently healthy participants (NHTN) (n = 80) were recruited for the study. Male to female ratio in the two groups were similar. Based on American Heart Association (AHA) classification, the hypertensive participants were categorized by age in years into three, (18 - 39), (40 - 65) and (>65) with prevalence of 43.1%, 55.6% and 1.3% respectively. Adopting WHO classification, participants were grouped based on their BMI into four, namely; underweight, optimal, overweight and obese with prevalence of 6.9%, 45.6%, 14.4%, and 33.1% accordingly. Both obesity and hypertension were further categorized using appropriate AHA approach and the percentages were presented on the table. The mean age for the two groups were similar and comparable. All participants were of Black ethnicity. Virtually all the participants involved in this study were asymptomatic.

#### *3.1.1. Comparison of hematological, coagulatory and inflammatory biomarkers between newly-diagnosed hypertensive and non-hypertensive control*

Table 2 revealed the outcome of the comparative analysis of different parameters between newly-diagnosed hypertensive participants and non-hypertensive. As it was evident on the table, only WBC, CRP, TNF and IL-6 were significantly elevated in NDHTN, ($p = 0.001$), ($p = 0.001$), ($p = 0.004$) and ($p = 0.046$) respectively. Though hemoglobin level and aPTT were moderately higher in NDHTN, but it was not significant.

#### *3.1.2. Bar chart showing the percentage of true positive and false positive prediction of the three inflammatory biomarkers among NDHTN.*

Figure 1 is the representation of the percentage of participants that had elevated level of inflammatory biomarkers in NDHTN and NHTN. The mean value plus upper reference value of each inflammatory marker was adopted as cutoff value for determining high value. CRP was elevated in 95% of NDHTN and only in 5% of NHTN. For the TNF and IL-6, elevated values were recorded in only 35% and 30% of NDHTN and 4% and 2% respectively.

#### *3.1.3. The validity of inflammatory biomarkers as the classifier of hypertension*

Table 4.4 show the performance of each inflammatory biomarker in predicting the occurrence of HTN. CRP displayed a superior performance in the aspect of sensitivity (73%), specificity (75%), and negative likelihood ratio (0.36), positive (95%) and negative (30%) predictive values. On the other hand, TNF and IL-6 performed better in negative likelihood ratio.

#### *3.1.4. The outcome of correlation analysis between CRP and hematological parameters in NDHTN*

In Table 3, the values of selected hematological parameters in NDHTN were correlated. The results showed significant positive correlation between HCT and HBG ($r = 0.857$, $p = 0.000$), RBC and HBG ($r = 0.681$, $p = 0.000$), RBC and HCT ($r = 0.857$, $p = 0.000$), RBC vs. MCV ($r = 0.428$, $p = 0.000$). However, negative significant correlation exists between RBC and MCH ($r = -0.357$, $p = .000$).

#### *3.1.5. The outcome of correlation analysis between CRP and lipid profile in NDHTN*

Table 4 revealed the outcome of correlation analysis of CRP and lipid profile parameters in newly diagnosed hypertension. The results showed a significant positive correlation between TC and LDL ($r = -0.710$, $p = 0.000$), TC and TC/TG ($r = -0.580$, $p = 0.000$), LDL and TC/HDL ($r = -0.380$, $p = 0.000$), and LDL/TG/HDL ($r = 0.610$, $p = 0.003$). However, negative significant correlation exists between HDL and TC/HDL ($r = 0.810$, $p = .000$).

**Table 1** Demographics and clinical data of the participants

| **Characteristics** | | **NDHTN** | **Non-HTN** |
|---|---|---|---|
| Age (years) | 18 – 39 | 69 (43.1) | 49 (61.3) |
| | 40 – 64 | 89 (55.6) | 29 (36.3) |
| | ≥ 65 | 2 (1.3) | 2 (2.5) |
| Sex | Male | 61 (38.1) | 32 (40) |
| | Female | 99 (61.9) | 48 (60) |
| BMI ($Kgm^2$) | < 18.5 | 11 (6.9) | 2 (2.5) |
| | 18.5 – 24.9 | 73 (45.6) | 57 (71.3) |
| | 25 – 29.9 | 23 (14.4) | 17 (21.3) |
| | ≥ 30 | 53 (33.1) | 2 (2.5) |
| Category of obesity | 1 (30 – 34.9) | 22 (13.8) | 2 (2.5) |
| | 2 (35 – 39.9) | 27 (16.9) | 0 |
| | 3 (≥ 40) | 4 (2.5) | 0 |
| Marital status | Married | 138 (86.3) | 70 (87.5) |
| | Single | 22 (13.8) | 10 (12.5) |
| Stage of HTN | 140-159/90-99 | 143 (89.4) | NA |
| | 160-179/100-109 | 17 (10.6) | NA |
| | ≥180/≥110 | 0 | NA |
| Symptomatic | Headache | 106 (66.3) | 8 (10) |
| | Dizziness | 37 (23.1) | 2 (2.5) |
| | No sign | 26 (16.3) | - |
| Comorbidity with Diabetes | Yes | 28 (17.5) | NA |
| | No | 132 (82.5) | NA |
| Systolic BP (mmHg) | ---- | 149.10 ± 8.82 | 106.03 ± 3.85 |
| Diastolic BP (mmHg) | ---- | 94.90 ± 3.62 | 76.36 ± 1.73 |

The values are occurrences (%) and mean ± standard deviation

**Table 2** Comparison of hematological, coagulatory and inflammatory between newly-diagnosed hypertensive and non-hypertensive control

| **Parameters** | **NDHTN** | **Non-HTN** | **P-value** |
|---|---|---|---|
| White blood cells count (x $10^9$/L) | 5.67 ± 1.61 | 3.14 ± 1.03 | 0.001* |
| Lymphocytes (%) | 55.22 ± 13.68 | 61.21 ± 9.20 | 0.342 |
| Neutrophil (%) | 34.73 ± 11.85 | 31.62 ± 9.50 | 0.169 |
| Monocytes (%) | 8.87 ± 3.32 | 7.4 ± 4.66 | 0.122 |
| Red blood cells count (x $10^{12}$/L) | 4.43 ± 0.78 | 4.24 ± 0.63 | 0.143 |
| Hemoglobin (g/dL) | 12.32 ± 1.72 | 11.77 ± 1.41 | 0.065 |
| Hematocrit (%) | 38.98 ± 6.11 | 35.58 ± 3.86 | 0.102 |

| | | | |
|---|---|---|---|
| MCV (fL) | 89.12 ± 12.00 | 87.11 ± 5.49 | 0.111 |
| MCH (Pg) | 28.86 ± 7.56 | 27.95 ± 1.99 | 0.233 |
| MHCH (g/dL) | 32.28 ± 5.27 | 34.44 ± 0.97 | 0.234 |
| Platelet count (x $10^9$/L) | 222.25 ± 67.15 | 222.73 ± 53.73 | 0.953 |
| aPTT (sec) | 29.58 ± 3.98 | 25.24 ± 5.69 | 0.065 |
| INR | 1.31 ± 0.35 | 1.31 ± 0.21 | 0.941 |
| Fibrinogen (g/L) | 2.92 ± 0.59 | 2.93 ± 0.27 | 0.597 |
| C-reactive protein (mg/L) | 57.34 ± 11.83 | 31.17 ± 17.73 | 0.001* |
| IL-6 (pg/mL) | 0.85 ± 0.89 | 0.42 ± 0.44 | 0.004* |
| Tissue necrosis factor (pg/mL) | 0.76 ± 0.86 | 0.45 ± 0.72 | 0.046* |
| Total cholesterol (mmol/L) | 6.85 ± 0.68 | 4.64 ± 1.86 | 0.094 |
| HDL-cholesterol (mmol/L) | 1.08 ± 0.57 | 1.19 ± 0.46 | 0.402 |
| LDL- cholesterol (mmol/L) | 3.86 ± 0.53 | 2.94 ± 0.91 | 0.056 |
| Triglyceride (mmol/L) | 1.68 ± 0.54 | 1.43 ± 0.72 | 0.203 |
| TC/TG | 2.68 ± 0.53 | 1.67 ± 0.59 | 0.045* |
| HDL/TG | 0.71 ± 0.30 | 1.01 ± 0.20 | 0.038* |

The values are mean ± standard deviation, Student t-test was used to compare the means and p = 0.005, MCH = mean corpuscular hemoglobin, MCHC = mean corpuscular hemoglobin concentration, MCV = mean corpuscular volume, aPTT = activated partial thromboplastin time. PT = prothrombin time.

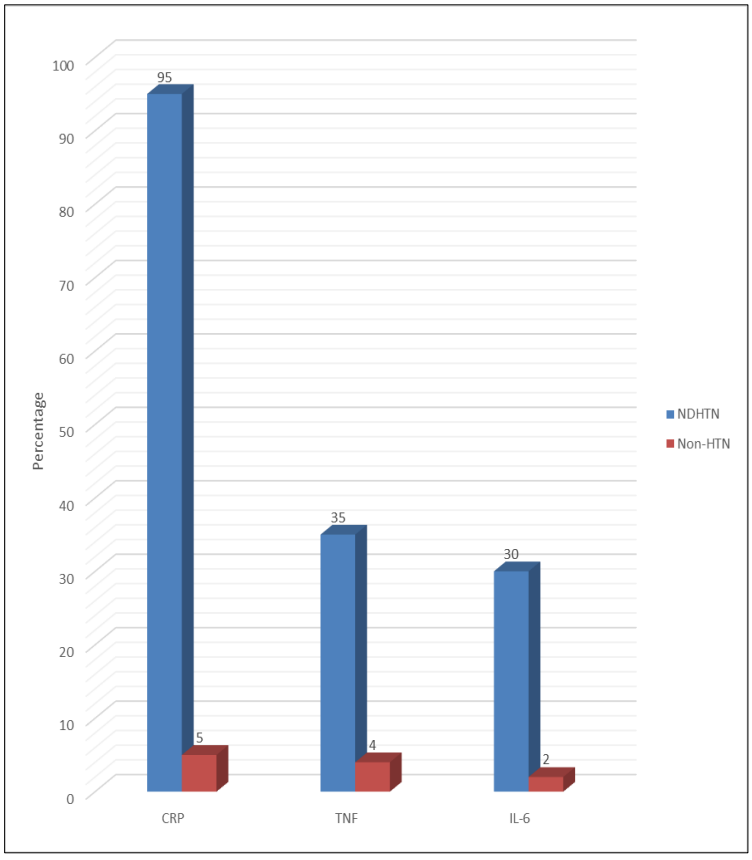


**Figure 1** The percentage true positive and false positive prediction of the three inflammatory biomarkers among NDHTN

**Table 3** The validity of inflammatory biomarkers as the classifier of hypertension

| IMs | Sens. | Spec. | PLR | NLR | PPV | NPV | Accu. |
|---|---|---|---|---|---|---|---|
| CRP | 73.08 | 75.00 | 2.92 | 0.36 | 95.00 | 30.00 | 73.33 |
| TNF | 26.92 | 80.00 | 1.35 | 0.91 | 89.74 | 14.41 | 34.00 |
| IL-6 | 23.08 | 90.00 | 2.31 | 0.85 | 93.75 | 15.25 | 32.00 |

Note: Values represent percentage (%), IM = Inflammatory markers, CRP = C-reactive protein, TNF = Tissue necrosis factor, IL-6 = Inter leukine-6, Sens. = Sensitivity, Spec = Specificity, PLR = Positive likelihood ratio, NLR = Negative likelihood ratio, PPV = Positive predictive value, NPV = Negative predictive value, Accu. = Accuracy

**Table 4** Correlation analysis of between CRP and hematological parameters in newly-diagnosed hypertension in Ogbomosho

| Correlation | | CRP | PLT | WBC | HBG | RBC | LYM | MCV | FBRN |
|---|---|---|---|---|---|---|---|---|---|
| CRP | r | | | | | | | | |
| | p | 1 | | | | | | | |
| PLT | r | -0.055 | | | | | | | |
| | p | 0.545 | 1 | | | | | | |
| WBC | r | 0.042 | 0.294 | | | | | | |
| | p | 0.632 | 0.001* | 1 | | | | | |
| HBG | r | 0.028 | -0.050 | -0.045 | | | | | |
| | p | 0.757 | 0.178 | 0.618 | 1 | | | | |
| RBC | r | 0.108 | -0.045 | 0.500 | 0.556 | | | | |
| | p | 0.222 | 0.625 | 0.000* | 0.000* | 1 | | | |
| LYM | r | 0.122 | -0.480 | -0.381 | -0.143 | -0.130 | | | |
| | p | 0.167 | 0.000* | 0.000* | 0.107 | 0.140 | 1 | | |
| MCV | r | -0.045 | 0.030 | 0.016 | 0.103 | -0.396 | 0.188 | | |
| | p | 0.618 | 0.750 | 0.861 | 0.623 | 0.000** | 0.039* | 1 | |
| FBRN | r | -0.038 | -0.238 | -0.081 | -0.157 | 0.428 | 0.216 | -0.195 | |
| | p | 0.694 | 0.008* | 0.355 | 0.128 | 0.000* | 0.014* | 0.129 | 1 |

WBC = white blood cells count, HBG = hemoglobin level, RBC = red blood cell count, MCH = mean corpuscular hemoglobin, MCHC = mean corpuscular hemoglobin concentration, MCV = mean corpuscular volume, RBC = red blood cells count,* = Correlation is significant at $p < 0.05$

**Table 5** Correlation analysis of CRP and lipid profile in newly-diagnosed hypertension in Ogbomosho

| Correlation | | CRP | TC | TG | HDL | LDL | TC/HDL | TC/TG |
|---|---|---|---|---|---|---|---|---|
| CRP | r | | | | | | | |
| | p | | | | | | | |
| TC | r | 0.065 | | | | | | |
| | p | 0.662 | 1 | | | | | |
| TG | r | 0.012 | 0.007 | | | | | |
| | p | 0.996 | 0.960 | 1 | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| HDL | r | 0.025 | 0.278 | 0.080 | | | | |
| | p | 0.925 | 0.556 | 0.590 | 1 | | | |
| LDL | r | 0.207 | 0.710 | 0.085 | 0.185 | | | |
| | p | 0,191 | 0.000* | 0.490 | 0.303 | 1 | | |
| TC/HDL | r | -0.084 | 0.035 | 0.182 | -0.810 | 0.380 | | |
| | p | 0.496 | 0.875 | 0.138 | 0.000** | 0.000* | 1 | |
| TC/TG | r | -0.082 | 0.580 | 0.183 | 0.084 | 0.610 | -0.847 | |
| | p | 0.969 | 0.000* | 0.136 | 0.570 | 0.003* | 0.748 | 1 |

CRP = C-reactive protein, TC = Total cholesterol, TG = Triglycerides HDL = High density lipoprotein, LDL = Low density lipoprotein * = Correlation is significant at $p < 0.05$

## 4. Discussion

The American Heart Association (AHA) age classification was adopted in this study, considering the age distribution and demographics of the participants. Based on AHA, the participants were grouped into three age categories; young (18-39), middle aged (40-64) and older (≥65). The age group mostly affected by hypertension was 40-64 years, with 55.6% of NDHTN patients in this age bracket, compared to 36.3% in the Non-HTN group. Our finding aligns [10]. Globally, studies showing that hypertension prevalence increases with age due to arterial stiffness and cumulative exposure to risk factors [11]. Our finding further revealed that younger adults (18-39 years) had a higher representation among the Non-HTN group (61.3%) compared to the NDHTN group (43.1%). This indicates a protective effect of youth against hypertension, supported by findings from the Framingham Heart Study. The implication of this finding ones need to watch lifestyle toward middle age, because environmental influence and lifestyle contribute to onset of hypertension.

The impact of gender as it was evident to plays a role on the incidence of HTN. The way in which gender affects these determinants and consequences may vary according to the conditions selected and according to the characteristics of the population studied. However, gender analysis is key to understanding the experience of health and how to intervene to prevent illness. Females constituted a larger percentage of the NDHTN group (61.9%) compared to males (38.1%). This trend may be related to hormonal changes, particularly postmenopausal estrogen decline, which is a known risk factor for hypertension in women [12]. Similar proportions were observed in the Non-HTN group, with females accounting for 60%. This suggests that while hypertension prevalence may be higher in females, other factors such as lifestyle, genetics, and environment could contribute.

The outcome of this study on obesity revealed that obesity is a significant risk factor for hypertension (Table 1). It was evidenced that the prevalence of hypertension were higher among overweight (25–29.9 $kg/m^2$) and obesity (≥30 $kg/m^2$) in the NDHTN group (33.1%) compared to the Non-HTN group (2.5%). Obesity categories 2 and 3 were even exclusive to NDHTN patients as shown on the table, emphasizing the strong correlation between severe obesity and hypertension. This is consistent with findings from the study by [13], which demonstrated a linear relationship between BMI and blood pressure levels. Normal BMI (18.5–24.9 $kg/m^2$) was predominant in the Non-HTN group (71.3%), further highlighting the protective role of maintaining a healthy weight.

### 4.1. Hematology and coagulatory parameters

Table 2 shows the outcome of comparative analysis of hematological and coagulatory parameters between NDHTN and NHTN, as it was revealed on the table, there were no significant differences in the entire parameters except total WBC. This observation was similar to what was reported earlier by [12]. The elevation of WBC in newly diagnosed hypertension highlights the contribution of inflammation and immune activation to the disease's pathophysiology. Elevated WBCs are associated with increased risk of target organ damage, including vascular remodeling, and myocardial hypertrophy. As shown by [14], elevated WBC counts are predictive of future cardiovascular events, emphasizing their utility as an early marker of cardiovascular risk in hypertensive patients. Hypertension, particularly chronic or poorly controlled cases, has been associated with changes in hematological parameters, such as increased leukocyte count, platelet count, and hematocrit levels, due to low-grade inflammation and endothelial activation [3]. However, in newly diagnosed patients, these changes might not yet be significant or differ substantially.

### 4.2. Inflammatory biomarkers

The role of immune system activation in hypertension has gained attention, with studies highlighting the involvement of T cells, cytokines, and other immune markers in blood pressure regulation and end-organ damage [15]. The observed significant elevation of CRP, TNR and IL-6 in NDHTN patients suggests a role for chronic low-grade inflammation in the pathogenesis of hypertension. The three above listed biomarkers have excellent pro-inflammatory activity and immune dysregulation, which may contribute to vascular remodeling and endothelial dysfunction, which are the key features of hypertension [14]. According to [11], elevated TNF and IL-6 levels are predictive of future cardiovascular events, particularly in hypertensive patients, and they stimulates hepatic production of acute-phase reactants, such as CRP [17]. CRP directly contributes to endothelial dysfunction through various mechanisms. It downregulates eNOS, reducing NO production and promoting vasoconstriction [16]. It stimulates the production of ROS and pro-inflammatory cytokines, perpetuating a cycle of oxidative stress and inflammation. It induces monocyte adhesion to endothelial cells and their differentiation into macrophages, accelerating atherosclerotic plaque formation. Molecular studies, such as those by [6], have shown that CRP interacts with complement system components, amplifying vascular inflammation and contributing to hypertension's progression. In view of the above background, the elevated levels of TNR, IL-6, and CRP in hypertension are not just diagnostic markers but represent active contributors to the disease's pathogenesis. Targeting these pathways may provide new therapeutic avenues for managing hypertension and its complications.

As reflected in Table 3, comparative analysis between the three inflammatory markers evaluated identified CRP as a robust marker of inflammation in hypertension, further linking chronic inflammation to cardiovascular risk.

### 4.3. Lipid profile

As it was evident from Table 4.3, there were no significant differences in plasma level of TC, TG, HDL and LDL between NDHTN and NHTN. This outcome is in line with that of [18] who reported that while hypertension contributes to endothelial dysfunction and lipid abnormalities over time, the early stages of hypertension may not yet lead to significant disruptions in lipid metabolism. Thus, dyslipidemia is a common comorbidity in hypertension, but differences in lipid profiles between non-hypertensive and newly diagnosed HTN may not be pronounced at early stage of the disease.. This could explain the lack of significant differences in lipid profiles between NHTN and NDHTN. Moreover, factors such as lifestyle, diet, and genetic predispositions may have a stronger influence on lipid levels than the grade of hypertension [6, 19].

### 4.4. CRP as a Predictive markers in NDHTN

Among the three inflammatory markers analyzed (CRP, TNF and IL-6), CRP stands out as the most reliable diagnostic marker for hypertension due to its superior balance of sensitivity, specificity, and overall accuracy (Table 4.5). CRP achieves a sensitivity of 73.08%, demonstrating its ability to correctly identify hypertensive individuals, and a specificity of 75.00%, indicating a strong capacity to exclude non-hypertensive cases [20]. These values contribute to its high accuracy of 73.33%, which surpasses the performance of both TNF (34.00%) and IL-6 (32.00%). CRP's positive likelihood ratio (PLR = 2.92) highlights its effectiveness, as a positive test result is nearly three times more likely in hypertensive individuals compared to non-hypertensive ones, while its low negative likelihood ratio (NLR = 0.36) reduces the risk of missing true hypertensive cases. Furthermore, CRP has an impressive positive predictive value (PPV = 95.00%), indicating that most positive results confidently identify hypertension, though its negative predictive value (NPV = 30.00%) reflects limitations in ruling out the condition in negative cases [17]. In contrast, TNF and IL-6 are less effective diagnostic markers, with sensitivities of only 26.92% and 23.08%, respectively, making them poor at identifying hypertensive individuals. While both markers exhibit higher specificities (80.00% for TNF and 90.00% for IL-6) and relatively high PPVs (89.74% and 93.75%, respectively), their low NPVs (14.41% and 15.25%, respectively) and high NLRs (0.91 and 0.85) significantly diminish their reliability, especially in excluding hypertension. Overall, CRP's combination of diagnostic metrics; including its higher sensitivity, specificity, and accuracy makes it the most effective marker for hypertension diagnosis, aligning with its established role as a systemic inflammatory marker often linked to cardiovascular conditions.

### 4.5. Correlation analysis

Table 4 and 5 represented the outcomes Pearson correlation analysis between CRP and hematology/coagulatory parameters and CRP and lipid profile respectively. We observed that hematological, coagulatory, and lipid profile parameters were not significantly correlated with CRP levels in NDHTN. Our outcome aligned with the findings from [20, 21]. CRP is an inflammatory biomarker often elevated in various cardiovascular conditions, including hypertension. Despite the finding of elevated CRP, dyslipidemia and hematological abnormalities in HTN, some of the studies did not found a significant correlation between these parameters and CRP levels. These finding suggest that while dyslipidemia

and altered hematological parameters are prevalent among hypertensive patients, their relationship with CRP levels is not straightforward and may be influenced by other factors.

## 5. Conclusion

This study reinforces the well-established links between hypertension and factors like age, obesity, and diabetes. The findings also emphasize the importance of lifestyle modifications to manage hypertension effectively. Similar studies in diverse populations have reported comparable patterns, underscoring the global relevance of these observations.

The lack of significant differences in lipid, some hematological, and lipid profile parameters between newly diagnosed hypertension and non-hypertensive patients suggests that these abnormalities may not manifest at early stage of hypertension, that it may require prolonged exposure to elevated blood pressure to become evident. These findings highlight the need for longitudinal studies to assess the progression of these changes in hypertensive patients over time.

Therefore, the lack of significant correlation in our findings is consistent with existing literature, indicating that CRP may not directly reflect changes in lipid or hematological parameters in newly diagnosed hypertensive individuals.

## Compliance with ethical standards

### *Disclosure of conflict of interest*

No potential conflict of interest relevant to this article was observed

### *Statement of ethical approval and informed consent*

The research was carried out in line with the ethics governing the use of human samples and in accordance with Helsinki declaration. Ethical practices such as participant consent, confidentiality and safety laboratory practice were observed in the course of the study.

### *Author's contribution*

- Kikelomo O.O..: Conceptualization, editing and validation of the study
- Janet O.O.: Carried out hematological and coagulation analysis
- Ibrahim E.S.: Carried out data curation, biochemical and statistical analysis.
- Saheed O.A.: Provide reagents, Proofreading, and final editing
- Ahmed O.Y.: Patient recruitment, data generation and Provision of reagents
- Motolani S.B.: Provision of reagent, editing and validation

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