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RESEARCH ARTICLE

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Evaluation of Neutrophil-Lymphocyte Ratio and Monocyte Count among Adult Obese Subjects in Sapele, Southern Nigeria

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Abstract

Background/Objectives: Obesity is a public health problem with hematological consequences in developing nations. This study aims to evaluate the impacts of obesity on hematological parameters such as: Neutrophil-Lymphocyte Ratio (NLR) and monocyte count among adults in Sapele. **Materialsand Methods:** This cross sectional and descriptive study was carried out at Central Hospital, Sapele, General Hospital, Oghara and Biomed Diagnostic Centre, Sapel all in Southern Nigeria. 415 subjects with age between 18 and 65years were enrolled for this study including 312 obese experimental subjects (comprising of 111males and 201females) and 103 non-obese normal control subjects (comprising 40males and 63females). 5.0mls of venous blood was collected from all subjects into EDTA container and Full Blood Count (FBC) was determined using Sysmex XN330 automated hematology analyzer while NLR was calculated from the FBC results. Collated data were analyzed using Student's t-test, One-way ANOVA, LSD post-hoc test and results were expressed as mean ± standard deviation. **Results:** Body-Mass-Index (BMI) of obese and control subjects were $36.82\pm0.55 kg/m^2$, and 20.43 ± 0.29 kg/m^2, respectively at $p<0.001$. Obese subject had hemoglobin (HB) concentration of 125.39 ± 1.26g/dl, the HB of control group was 127.27 ± 1.75 g/dl at $p>0.05$. On the other hand, Monocyte count for Obese subject was 6.40 ± 0.23 X 10^9/l, while control group had monocyte count of 5.14 ± 0.18 X 10^9/l, at $p<0.001$. Furthermore, the Neutrophil Lymphocyte Ratio (NLR) of obese and control subjects was 1.57 ± 0.21 and 1.18 ± 0.05 respectively. **Conclusion:** Obese subjects had significantly higher values of BMI, NLR, Monocyte count at $p<0.05$ when compared with control subjects in Sapele, Southern Nigeria.

Keywords: Obesity, Neutrophil Lymphocyte Ratio, Monocyte, Sapele

1 | INTRODUCTION

Obesity has emerged as a global health issue and one of the leading avoidable causes of mortality worldwide [1]. It is a medical condition in which excess body fat has accumulated to the level that produces adverse effect on health [2]. Uncontrolled body weight gain is associated with many chronic diseases such as: Cardiovascular diseases, type 2 diabetes mellitus, asthma, obstructive sleep apnea, cancer, bone diseases etc. Thereby, reducing human life expectancy globally [3]. In addition, obesity which is also a chronic inflammatory state is characterized by excess adipose tissue deposition. A strong positive correlation has been observed between physical activity and weight gain through earlier multiple cross sectional studies [4]. It has been established that this relationship is bidirectional in nature which implies that, obesity discourage physical activity while, inactivity promotes excessive weight gains that leads to obesity resulting in both cardiovascular and diabetic risk in individuals as well as enhances the severity of other risk factors.

A combination of high energy food intake and sedentary life style are the major causes of obesity.[4] However small number of cases are due principally to hereditary, medical reasons and mental illnesses, Decreased variability in ambient temperature, smoking, endocrine disruption, certain environmental pollutants and interference with lipid metabolism [5].

The main treatment for obesity consists of dieting and physical exercise [6] and concerted behavioral counseling is recommended for those who are either obese or at risk of obesity [7]. Also, Obesity has negative socio-economic impacts that leads to stigmatization in individuals, disadvantages in employment and reduced productivity.

The episode of obesity is on an increasing trend in developing country like Nigeria and it has remained a strong risk factor for build-up of chronic diseases with several impacts on hematological parameters including alterations in Neutrophil to lymphocyte ratio (NLR) and monocyte counts. NLR is used as a marker of subclinical inflammation in cancer and has been shown to be useful markers for prognosis in various clinical problems [8]. It is calculated by dividing the number of neutrophil by number lymphocyte often from peripheral blood sample [9]. NLR is also a marker of the body's immune responses.

On the other hand, monocyte which is the largest type of white blood cell usually facilitates healing, repair and influences the process of adaptive immunity. Also, monocytes are important in our immune system's ability to destroy invaders.

Although the clinical importance of NLR and monocyte count have been known but, the effects and alterations of NLR and monocytes in Obesity in South-South Nigeria and Sapele in particular is not well documented and remains to be clarified hence, this study aims to evaluate the effects of obesity on NLR and monocyte count in adult obese subjects in Sapele and its environs. In addition, having seen that obesity is both a global and local problem, which is associated with various diseases; this study also aims to provide the pivot upon which the pathophysiology associated with obesity can be identified in other to provide informative parameters for management and monitoring of individuals with obesity in Sapele.

Sapele is a city located in central part of Delta State, South-South Nigeria. It is positioned at a height of 9meters above sea level at latitude of 5.89^0 and a longitude of 5.68^0. Sapele has a population of about 174,273 (Population census, 2006) and accommodates different tribes such as: Okpe, Urhobo, Itsekiri, Ibo, Ijaw, Isoko, Hausa, Edo, Yoruba, Ibibio, Nupe, Tiv, Fulani. The main occupations in sapele are farming, factory worker, Artisan, Trader and Civil Servant. The common diets in this locality are starch, yam, garri, rice, beans, plantain, palm oil, fish, meat, perewinkle.

Inclusion Criteria

Obese adults within the age ranges of 18 and 65 years and resident in Sapele and its environ were recruited in the study.

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Exclusion Criteria

People that were critically ill and/or on any form of medication, pregnant women, hypertensive patient, patient with communicable and non-communicable diseases and those who refused consent where excluded from this study.

2 | MATERIALS AND METHODS

This is a cross sectional and descriptive study carried out at Central Hospital, Sapele, General Hospital, Oghara and Biomed Diagnostic Centre, Sapele. A total of four hundred and fifteen (415) subjects were enrolled for the study. These include three hundred and twelve (312) obese subjects (comprising of 111males and 201females), one hundred and three (103) non-obese subjects (comprising 40males and 63females) used as control.

Sample Collection

Four and half milliliters (4.5mls) of venous blood was collected from all participant into EDTA container. The blood sample was analyzed within one hour of collection using Sysmex XN330 automated hematology analyzer.

Ethical Approval

Ethical Clearance for this study was obtained from the Ethics committee of Central hospital, Sapele Medical Zone, Sapele, on 8^{th} of December, 2016 with Reference number SNZ/A.31VOL.3/54. Informed consent was also obtained from individuals as well as completed structured questionnaire.

Sample Analysis

The EDTA sample was placed in a position where the aperture is immersed in the blood and the aspirator button was pressed. A suspension of blood cell passes through a small orifice simultaneously with an electric current. After measurement, the reading of the cell count is displayed on the screen and result recorded.

Data Analysis

Data analysis was done using Microsoft Excel 2010 and Statistical Package for Social Sciences (IBM SPSS) version 21.0 software. The collated results were expressed as mean and standard deviation. Inferential analysis adopted include: Student's t-test, correlation and one-way analysis of variance (ANOVA) followed by least significant different (LSD) post-hoc test for the obese. Correlation between two variables was done using Pearson's linear regression analysis. Statistical significance was set.

3 | RESULTS

Table 1: NLR, PLR and Monocyte counts among obese and normal weight subjects

Parameter	Obese(n=312) Mean ±SEM	Normal(n=103) Mean ±SEM	t value	P value
NLR	1.57±0.21	1.18±0.05	2.273	0.034*
PLR	107.07±3.98	107.57±5.98	-0.071	0.943†
MONO(10^9/l)	6.40±0.23	5.14±0.18	3.911	0.000**

**Significant (p<0.01) *Significant (p<0.05)†Not Significant

Table 1: Shows the NLR, PLR and monocyte count of obese and normal weight subjects. Obese subjects had significantly higher monocyte counts at p<0.001 when compared with non-obese subjects. In addition, Obese subjects had significantly higher values of Neutrophil Lymphocyte Ratio (NLR) at P = 0.034 but no significant difference in Platelet Lymphocyte Ratio (PLR) at P value of 0.943.

Table 2: Comparison of Mean ±SEM of NLR, PLR and Monocyte counts variables between Obese and Control within the ages 20 –29, 30 -39, 40-49, (≥50years group)

Variables	Obese (n= 312) Mean ±SEM	Normal (n=103) Mean ±SEM	t-test	p-value
20-29 years	**n=75**	**n=22**		
NLR	1.96±1.61	1.32±0.67	1.325	0.003**
PLR	6.00±0.55	6.14±0.27	-0.232	0.817†
MONO(10^9/l)	7.29±2.33	5.17±1.38	7.593	0.001**
30-39 years	**n=99**	**n=33**		
NLR	1.86±1.60	1.22±0.66	1.234	0.002**
MONO(10^9/l)	6.29±2.33	4.17±1.48	7.583	0.001**
PLR	7.00±0.55	7.14±0.27	-0.242	0.816†
40-49 years	**n=90**	**n=30**		
NLR	1.81±1.62	1.13±0.54	2.940	0.04*
MONO(10^9/l)	5.89±2.17	5.08±1.14	1.158	0.249
PLR	6.08±0.55	6.22±0.27	-0.235	0.827†
≥50 years	**n=48**	**n=18**		
NLR	1.23±0.16	1.18±0.35	0.226	0.823
MONO(10^9/l)	5.85±2.64	4.65±0.17	1.436	0.163
PLR	5.90±0.55	6.04±0.27	-0.242	0.828†

**Significant (p< 0.01) *Significant (p< 0.05) †Not Significant

When comparing the NLR, PLR and Monocyte values of obese and non-obese subject within various age brackets, a significant difference in NLR and Monocyte values was observed. NLR and monocyte counts was higher among obese subjects than in non-obese subjects within the age brackets of 20-29, 30-39, 40-49 and subjects above 50years of age. But, PLR values shows no significant difference among obese and non-obese subjects in these age brackets as shown in table 2 above. Furthermore, differences in measured parameters based on sex was not observed as there was no significant difference in NLR, PLR and monocyte count values between obese males and obese females as well as between obese male and non-obese male in this study as shown in table 3 and 4below. On the other hand, there was significant difference in NLR and monocyte counts values among obese female and normal weight female subjects as shown in table 5. NLR and monocyte counts values were higher in obese females than in non-obese females (see table 5).

Table 3: NLR, PLR and Monocyte counts among normal weight male and normal weight female subjects**.**

Parameter	Normal male (n=40) Mean ±SEM	Normal female(n=63) Mean ±SEM	t value	P value
NLR	1.23±0.16	1.72±0.29	-1.127	0.264†
PLR	5.35±0.56	6.93±0.69	-1.445	0.154†
MONO(10^9/l)	6.77±0.70	6.29±0.23	0.824	0.412†

**Significant (p<0.01) *Significant (p<0.05) †Not Significant

Table 4: NLR, PLR and Monocyte count among obese and normal weight male subjects

Parameter	Obese male (n=111) Mean ±SEM	Normal male(n=40) Mean ±SEM	t value	P value
NLR	1.20±0.15	1.23±0.16	-0.125	0.902†
PLR	6.00±0.55	5.35±0.56	0.836	0.409†
MONO(10^9/l)	6.77±0.70	5.54±0.29	1.618	0.114†

Table 5: NLR, PLR and monocyte counts among obese female and normal weight female subjects

Parameter	Obese female (n=201) Mean ±SEM	Normal female(n=78) Mean ±SEM	t value	P value
NLR	1.73±0.29	1.21±0.06	2.340	0.021*
PLR	6.14±0.37	6.97±0.71	-1.313	0.192†
MONO(10^9/l)	6.32±0.23	4.95±0.21	3.802	0.000**

FIGURE 5: **Significant(p<0.01) *Significant (p<0.05)††Not Significant

4 | DISCUSSION

The evaluation of NLR and monocyte count in adult obese subjects in Sapele and its environs have been analyzed. Obese subjects had significantly higher monocyte values when compared with normal weight subjects. It implies that, excessive weight gains induce monocytosis, and this is in line with the observations made by Kyrill in 2010, adding that monocyte shows high endothelial affinity and a potent capacity to invade vascular lesions and transform into pro inflammatory cytokine producing macrophages [10]. Obesity is characterized by chronic low grade systemic inflammation that is expressed as monocytosis in obese individuals. Again, this is consistent with the findings of the same study, which reported that there was significant univariate association between monocytosis and obesity, as well as subclinical atherosclerosis in low risk individuals [10]. Furthermore, Revolo *et al.*, in 2014 reported that, obesity results to a complex adaptive changes in the adipocytes, with less compliance in the supporting tissue, blood supply and alteration in immunological milieu, that leads to cell death and chronic tissue hypoxia which triggers inflammatory processes leading to increase in NLR and monocyte counts [11].

In addition, Obese subjects had significantly higher Neutrophil Lymphocytes Ratio (NLR) compared with normal weight subjects. Neutrophils Lymphocytes Ratio (NLR) had positive correlation with Body Mass Index (BMI), this implies that excessive weight gain increases Neutrophil lymphocyte ratio. NLR is a simple index to evaluate inflammatory status of an individual. Kim and his colleagues in 2008 reported that, Obese subjects had an elevated circulating neutrophil levels and increased number of

blood cytokines in the circulation. The elevated neutrophil levels are attributed to its potential responses to persistent inflammation and tissue injury through antigenic presentation and secretion of chemokines, prostaglandins as well as leucotrienes [12]. Excessive weight gain leads to altered changes in adipose tissue activity that induces increase production of inflammatory marker which in turn plays great responsibilities in the pathogenesis of metabolic syndrome in obesity [13]. An event that results in increase inflammatory reaction, NLR and Monocyte count values.

5 | CONCLUSIONS

Neutrophil Lymphocyte Ratio (NLR) was significantly increased in obese subjects than in the normal weight subjects and can be used for assessment of inflammatory status in the obese subjects in Sapele. Monocyte count was significantly elevated in the obese group when compared with the controls and this study noted that obesity induces inflammation in all individuals irrespective of gender and age.

Recommendation

Obesity should no longer be seen as sign of wealth and affluence as it is believed in Nigeria but rather, as an abnormal health condition, which is associated with wide spectrum of metabolic disorders.

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Conflict of Interest:

There is no conflict of interest regarding this work among the authors.

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