Haematological Parameters Among Obese and Non-Obese Individuals in Sapele, Southern Nigeria

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ABSTRACT

Background: Obesity is a medical condition that is characterized by excess adipose tissue deposition and inflammatory state that result in poor health and changes in haematological parameters. **Objectives**: This study aims to evaluate pattern of changes in hematological parameters among obese and non-obese individuals in Sapele, Nigeria. **Method**: This study was carried out at Central Hospital, Sapele, General Hospital, Oghara and Biomed Diagnostic Centre, Sapele in Southern Nigeria. 415 subjects with ages between 18 and 65years were enrolled for this study including 312 obese experimental subjects (comprising of 111 males and 201 females) and 103 non-obese normal control subjects (comprising 40 males and 63 females). 5.0mls of venous blood was collected from all subjects into EDTA container and Full Blood Count was determined using Sysmex XN330 automated haematology analyzer. **Result:** Packed Cell Volume of the obese and non-obese individuals were 39.52±3.80% and 39.55±0.55% while obese and non-obese persons had total white blood cell count of 6.38±0.54 X109/L and 5.94±0.28X109/L respectively. Monocyte count of obese and non-obese individuals was 6.40±0.23X109/L and 5.14±0.18X109/L while Neutrophil-lymphocyte ratio (NLR) of obese and non-obese people was 1.57±0.21 and 1.18±0.05 respectively. **Conclusion**: People with obesity had significantly higher values of monocyte count and NLR when compared to non-obese individuals while there was no significant difference in measured hematological parameters among obese and non-obese people in Sapele Southern Nigeria.

Keywords: Hematological, Parameters; Obesity, Sapele

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Introduction

Obesity is a medical condition in which excess body fat has accumulated to the level that produces a negative effect on our health. It has emerged as a global health problem and one of the leading preventable causes of mortality globally.[1,2.] There is a rising trend of obesity in developed and lower-income countries like Nigeria resulting in poor health status and low economic productivity.[3] Obesity and uncontrolled bodyweight gain is associated with many chronic diseases such as cardiovascular diseases, type 2 diabetes mellitus, asthma, obstructive sleep apnea, cancer, reduce life expectancy, etc.[4] Ultimately, people are obese if their body mass index (BMI) is above 30.0.[5] A combination of too much energy food intake and a sedentary lifestyle are the major causes of obesity, which ultimately results in the formation of excess adipose tissue either in the visceral or in the subcutaneous cavity.[6] However a small number of obese cases are due principally to hereditary, disruptors environmental pollutants and interference with lipid metabolism.[7]

Yilmazi et al reported that excessive weight gain and obesity lead to altered changes in adipose tissue activity that induces increased production of inflammatory marker which in turn plays a great role in the pathogenesis of metabolic syndrome and disruption in lipid metabolism.[8]

Furthermore, in obesity, there is a chronic inflammatory state characterized by excess adipose tissue deposition, building up of adipocytokines such as inflammatory mediators and abnormal metabolic regulators and this inflammatory state results in alteration of physiological mechanisms leading to changes in hematological parameters.[9] These haematological parameters include Red cell and red cell indices, platelet count and platelet indices and white cell count. Therefore, this study aims to evaluate the changes in Haematological Parameters between Obese and Non-Obese Individuals in Sapele, Southern Nigeria to provide an informative strategy for better management of people with obesity in this locality.

Sapele is a city located in the central part of Delta State, South-South Nigeria. It is positioned at a height of 9meters above sea level at a latitude of 5.890 and a longitude of 5.680. 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 and 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, periwinkle.

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

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

Method
This was 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 111 males and 201 females), one hundred and three (103) non-obese subjects (comprising 40 males and 63 females) used as control.

Sample Collection
Four and a half milliliters (4.5mls) of venous blood was collected from all participants 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 8th of December 2016 with Reference number SNZ/A.31VOL.3/54. Informed consent was also obtained from individuals as well as a 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 cells passes through a small orifice simultaneously with an electric current. After measurement, the result of the cell count and hematological parameters was displayed on the screen and the 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 included Student's t-test. Statistical significance was set at $P < 0.05$.

Results
The mean value of Packed Cell Volume (PCV) of the obese and non-obese individual were 39.52±3.80% and 39.55±0.55% respectively and the haemoglobin (HB) level of people with obesity was 125.39±1.26g/dL while non-obese people had haemoglobin level of 127.27±1.75g/dL. On the other hand, red blood cell (RBC) count of obese people was 4.55±0.05X1012/L while non-obese individuals had RBC count of 4.65±0.08X1012/L. Furthermore, obese and non-obese persons had total white blood cell

(tWBC) count of 6.38±0.54 X109/L and 5.94±0.28X109/L respectively. Nevertheless, Platelet (PLT) count and Neutrophil (Neut) count of obese people were 247.57±7.67X109/L and 3.01±0.33X109/L while PLT and NEUT count of non-obese individuals were 236.73±11.67X109/L and 3.01±0.26X109/L as shown in table 1. In addition, the lymphocyte (LYMPH) count of people with obesity was 2.59±0.19X109/L while non-obese people had lymphocyte count of 2.38±0.10X109/L. The monocyte (MONO) count of obese and non-obese individuals was 6.40±0.23X109/L and 5.14±0.18X109/L respectively. Eosinophil (EOSINO) count and Basophil (BASO) count of people with obesity were 3.44±0.15X109/L and 0.35±0.03X109/L while EOSINO and BASO count of non-obese individuals were 3.81±0.15X109/L and 0.39±0.06X109/L.

Comparison of haematological parameters shows that the value of monocyte was significantly higher in people with obesity than in non-obese people while there was no significant difference in values of PCV, HB, RBC, tWBC, PLT, NEUT, LYMPH, EOSINO, and Basophil count among obese and non-obese people as shown in table 2.

Table 2 shows the mean values of haematological indices among obese and non-obese individuals in which, Neutrophil-Lymphocyte Ratio (NLR) of obese and non-obese people was 1.57 ± 0.21 and 1.18 ± 0.05 respectively. Also, the Platelet-Lymphocyte Ratio (PLR) of people with obesity was 107.07 ± 3.98 while non-obese people had a PLR value of 107.57 ± 5.98. Furthermore, Mean Platelet Volume (MPV) of people with obesity was 8.31±0.08fL while non-obese people had MPV of 8.57 ± 0.15fL. The Platelet Distribution Width (PDW) and Platocrit (Pcrit) of obese individuals were 15.89 ± 0.04% and 0.20±0.01%. PDW and Pcrit of non-obese people were 18.28 ± 2.37% and 0.20 ± 0.01% respectively. Comparison of haematological indices shows that NLR value was significantly higher in people with obesity than in non-obese people while there was no significant difference in values of PLR, MPV, PDW and Pcrit among obese and non-obese people as shown in table 2.

Table 1: Mean ± SEM of haematological parameters among obese and non-obese subjects

Parameter	Obese(n=312) Mean ± SEM	Normal(n=103) Mean ± SEM	t value	P value
PCV(%)	39.52 ± 3.80	39.55 ± 0.55	-0.060	0.953†
HB(g/dl)	125.39 ± 1.26	127.27 ± 1.75	-0.897	0.371†
RBC(10^{12}/l)	4.55 ± 0.05	4.65 ± 0.08	-1.127	0.261†
tWBC(10^9/l)	6.38 ± 0.54	5.94 ± 0.28	0.384	0.702†
PLT(10^9/l)	247.57 ± 7.67	236.73 ± 11.67	0.788	0.432†
NEUT(10^9/l)	3.01 ± 0.33	3.01 ± 0.26	-0.009	0.993†
LYMPH(10^9/l)	2.59 ± 0.19	2.38 ± 0.10	0.798	0.426†
MONO(10^9/l)	6.40 ±0.23	5.14 ± 0.18	3.911	0.000**
EOSINO(10^9/l)	3.44 ± 0.15	3.81 ± 0.15	-1.575	0.117†
BASO(10^9/l)	0.35 ± 0.03	0.39 ± 0.06	-0.604	0.547†

**Significant (p<0.01) † Not Significant

Table 2: Mean ±SEM of haematological indices among obese and non-obese individuals

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†
MPV(fL)	8.31 ± 0.08	8.57 ± 0.15	-1.787	0.078†
PDW(%)	15.89 ± 0.04	18.28 ± 2.37	-1.306	0.193†
Pcrit(%)	0.20 ± 0.01	0.20 ± 0.01	0.642	0.522†

*Significant (p<0.05) †Not Significant
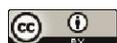
Discussion

Obesity subject had no significant impact on values of hemoglobin, packed cell volume and red blood cell count compared with normal weight subject, this implies that weight gain does not affect haematopoietic processes and iron metabolism, this result is in agreement with an earlier study, which reported that overweight and obese subjects do not have lower hemoglobin and red blood cell count and obesity results when excess energy intake exceeds energy usage, which does not considerably affect iron metabolism to cause anemia in adult obese subjects.[10] Nevertheless, people with obesity had significantly higher monocyte count when compared with non-obese people. This implies that obesity and excessive weight gains induce monocytosis and this is in line with observations made earlier by an author that monocyte shows high endothelial affinity and a potent capacity to invade vascular lesions and transform into pro-inflammatory cytokine producing macrophages that eventually result to increase monocyte in blood.[11] In addition, obesity is characterized by chronic low-grade systemic inflammation state that triggers increase expression of monocytosis in the obese individuals and this is consistent with the findings of the same study, which reported that there was a significant univariate association between monocytosis and obesity, as well as subclinical atherosclerosis in obese individuals.[12] On the other hand, obese subjects had significantly higher Neutrophil-Lymphocytes Ratio (NLR) value when compared with normal non-obese people and this implies that obesity and excessive weight gain increases the NLR due to inflammatory processes that are common in obesity. Remember, NLR is a simple index to evaluate the inflammatory status of an individual and according to Kim and his colleagues in 2008, obese subjects had elevated circulating neutrophil levels and an increased number of blood cytokines such as TNF-α, IL-1β, IL-8 and IL-6 in the circulation.[12] The elevated neutrophil levels are attributed to its potential responses to persistent inflammation and tissue injury which are frequently seen in obesity through antigenic presentation and secretion of chemokines, prostaglandins as well as leucotrienes.[13] However, people with obesity had no significant difference in packed cell volume, hemoglobin, red blood cells count, white blood cell count, platelets count, Neutrophils, Lymphocytes, Eosinophils and Basophils count when compared with normal non-obese people and this result is a further pointer that obesity had no significant effect on haematopoietic activities and most blood cell proliferations. In addition, there was no significant difference in platelet count between obese and non-obese individuals and this result defers from earlier reports that platelet count and platelet indices were increased in people with obesity.[14,15]

Conclusion

People with obesity had a significantly higher value of monocyte count and Neutrophil-lymphocyte ratio when compared to non-obese individuals. This is implying that there could be a systemic inflammatory state in people with obesity. While there was no significant difference in values of Packed cell volume, haemoglobin, red blood cell, total white blood cell, Platelet, Neutrophil, Lymphocyte, Eosinophil, Mean Platelet Volume, Platelet Distribution Width, and Basophil count among obese and non-obese people in Sapele Southern Nigeria.

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