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ASSESSMENT OF HAEMATOLOGICAL PARAMETERS AND BODY MASS INDEX AMONG GERIATRIC OUT- PATIENTS IN EKPOMA, EDO STATE

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ABSTRACT: *Aging is associated with physiological changes that affect various bodily systems, including the hematological system. This study aimed to evaluate hematological parameters and Body Mass Index (BMI) in geriatric subjects (≥60 years) and compare them with apparently healthy young adults (20-33 years). A total of 100 subjects (50 geriatrics and 50 controls) were recruited for this study. Hematological parameters, including white blood cell count, lymphocyte count, granulocyte count, red blood cell count, hemoglobin concentration, packed cell volume, mean corpuscular volume, mean corpuscular hemoglobin, mean corpuscular hemoglobin concentration, and platelet count, were assessed. BMI was calculated, and comparisons were made between geriatric and control groups. The results showed higher BMI values in geriatric subjects, although not statistically significant. White blood cell count was lower in geriatric subjects, while lymphocyte count, granulocyte count, and platelet count showed no significant differences. Hemoglobin concentration and packed cell volume were significantly higher in geriatric subjects. The findings suggest that ageing is associated with changes in hematological parameters and BMI, which may not necessarily indicate disease. The study's results are consistent with World Health Organization (WHO) criteria for hematological values among blacks and highlight the importance of considering age-related changes in hematological parameters when assessing the health status of geriatric subjects.*

KEYWORDS: Hematological parameters, BMI, Hematometer, Geriatrics.

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INTRODUCTION

Background to the Study

Geriatrics is the branch of medicine concerned with all aspects of health and illness in older adults. Aging is related to a progressive decline in the functional reserve of multiple organ systems increasing the probability of dysfunction and disease (Coresh, Astor, Greene, Eknoyan & Levey, 2013). Laboratory tests are often used to screen for disease in the elderly, particularly in the setting of non-specific presentation of acute illness. Hematopoiesis is maintained by the balance between production and destruction of blood cells. Hematopoietic modulation becomes imbalanced with ageing. The reason for this phenomenon is related to the decrease in the bone marrow's ability to respond to stimuli such as bleeding, infection and cytotoxic damage (Coresh *et al.*, 2013). Studies in this setting suggest a decline in the stem cell population reserve, imbalance in the hematopoietic cytokine production, decreased sensitivity of stem cells and precursor cells to the action of cytokines and alterations in the microenvironment impairing homing (Coresh *et al.*, 2013). Ageing is a biological process accompanied by gradual deterioration of the physiological functions and metabolic processes. This multifactorial process, which is affected by the sum of genetic and environmental factors, differently encompasses various organs and tissues (Coresh *et al.*, 2013)

In addition, the body mass index (BMI), or Quetelet index, is a value derived from the mass (weight) and height of an individual (Malcolm, 2015). Diagnosis of overweight and obesity using simple indicators like body mass index (BMI) is extensively consolidated in the literature (World Health Organization, 1998). Despite its limitations, this indicator has been systematically utilized in epidemiological studies for the diagnosis and evaluation of secular trends in overweight/obesity in children and adults (Monteiro, Victora, Barros & Vtomasi, 2000).

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Study Area

This study was carried out in Ekpoma. Ekpoma is regarded as the Headquarter of Esan West Local Government area of Edo State. It is located at latitude 6^{o} 45^{I}N and longitude 6^{o} 08^{I}E. It is moderately populated with the peoples' occupation being farming and trading. The main sources of water in the locality are rainfall and wells. The well is augmented by an irrigation scheme provided by the Government for public use. University is situated in this region. It is usually cold at night and very hot during the day. It also has undulating topography (World Gazetter, 2007).

Study Population

This study employed a total number of one hundred (100) subjects which consist of fifty (50) geriatrics and fifty (50) apparently healthy young subjects which served as the control group. Demographic information such as age and gender were obtained. The age ranges of the geriatric subjects were from 60 years and above while that of the control (young adult) were from 20-33 years.

Research Design

This research was designed to evaluate white cell count, differential white count, hemoglobin concentration, platelet count, packed cell volume and body mass index in geriatrics and make comparisons with apparently young healthy individuals (the control). This study was carried out within three (3) months September to November, 2018. The samples obtained were taken to the laboratory for analysis. The results generated were further used to make comparisons.

Inclusion Criteria

Only geriatrics subjects (both men and women) from sixty (60) years and above and without any underlying sickness or disease were included in this study. In addition, young adults between 20-33 years were also included but they served as the control.

Exclusion Criteria

Geriatrics and control subjects with any underlying sickness or disease were excluded in this study.

Sample Collection

Blood samples (5mls) were collected by vene-puncture into an accurately labelled EDTA container for both subjects and control. The collected blood samples were mixed properly in order to avoid clotting of the samples, the sample containers were labelled properly with the date of collection and participant's unique identification number. The laboratory analysis was carried out for total white cell count, differential white cell count, packed cell volume (PCV), Hemoglobin concentration (Hb) and platelets count.

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Body Mass Index Evaluation

Weight was measured after removal of shoes while wearing light clothing. Height was measured without shoes in the standing position with the shoulders in relaxed position and arms hanging freely. BMI was calculated as weight (kg)/height in meter square (Kg/m^2) (Kumanyika, 1994).

The classification of BMI according to WHO, (1998) is as follows:

Less than 18.5-Under weight

18.5-24.9 - Healthy weight range

25.0-29.9 - Overweight

More than 30.0-Obese.

Hematological Analysis

This was carried out using the Mythic 18 (Poland) for assessment of full blood count using whole blood or pre dilute mode. Whole blood is aspirated from the sample probe into the sample rotor valve; 6µl of blood measured by the sample rotor valve is transferred to the WBC transducer chamber along with 1.994ml of diluents. At the same time, 1.0ml of WBC/HGB lyse is added to prepare a 1:500 dilution sample. When the solution is made to react in this state for approximately 10 seconds, RBC is haemolysed and platelets shrink with WBC membrane held as they are. At the same time, hemoglobin is converted into red coloured met-haemoglobin. Of the diluted/haemolysed sample in the WBC transducer chamber approximately 1.0ml is transferred to the HGB flow cell. 500 µl of sample in the WBC transducer is aspirated through the aperture. The pulses of the blood cells when passing through the aperture are counted by the DC detection method. In the HGB flow cell, a 555nm wavelength beam irradiated from the light emitting diode (LED) is applied to the sample in the HGB flow cell. Concentration of this sample is measured as absorbance. This absorbance is compared with the diluents alone that was measured before addition of the sample, thereby calculating HGB (hemoglobin value).

Data Analysis

The results obtained in this study were analyzed statistically using Student's t-test, ANOVA and Pearson Moment correlations. Values at $p<0.05$ were regarded as significant. All data were expressed as Mean ± SD.

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RESULTS

The results in table 4.1 revealed the hematological parameters and BMI levels of male geriatrics and control. The results of this study showed that BMI were higher ($p>0.05$) in male geriatrics subjects (22.94±4.57 kg/m^2) when compared with the control subjects (21.23±4.40 kg/m^2). The levels of WBC were lower ($p>0.05$); though not significantly different in male geriatrics (5.20± 1.82 10^{12}/L) as compared to the control (5.48 ± 1.91 10^{12}/L). The levels of lymphocytes were higher ($p>0.05$) in male geriatrics (2.27 ± 0.66 g/dl) as compared to the control (4.25± 5.35 g/dl). The values of granulocytes, red blood cell count, hemoglobin, MCV, MCH, MCHC and platelets were not significantly different ($p>0.05$) when the male geriatrics were compared to the control. Packed cell volume was significantly higher ($p<0.05$) when male geriatrics (41.58± 5.75%) was compared with the control (38.34± 3.55 %).

Table 4.1: Some Hematological Parameters and BMI of Male Geriatrics and their Control Counterparts

PARAMETERS	Geriatrics (n=50)	Control (n=50)	t value	P value
BMI (kg/m^2)	22.94±4.57	21.23±4.40	1.359	0.180
WBC (10^{12}/L)	5.20±1.82	5.48±1.91	-0.534	0.595
LYM (g/dl)	2.27±0.66	4.25±5.35	-1.905	0.063
MID (g/dl)	0.53±0.26	0.58±0.41	-0.476	0.636
GRA (g/dl)	2.46±1.22	3.17±1.58	-1.822	0.075
RBC (10^{12}/L)	4.84±0.76	5.04±2.39	-0.408	0.685
HB (g/dl)	12.93±2.77	12.01±1.39	1.471	0.148
HCT (%)	41.58±5.75	38.34±3.55	2.386	0.021
MCV (fL)	87.48±8.53	86.47±9.83	0.392	0.697
MCH (pg/cell)	27.09±4.10	27.47±5.37	-0.287	0.775
MCHC (g/dl)	34.45±8.23	32.99±6.18	0.950	0.482
PLT (10^{12}/L)	242.70±94.60	219.50±77.58	0.950	0.347

Key:

N=Sample Size

P<0.05= Significant

p>0.05=Not Significant

WBC= White blood cell count; LYM=Lymphocytes; MID= Monocytes; GRA; Granulocytes; RBC=Red blood cell count; HGB= Hemoglobin; HCT=Hematocrit; MCV= Mean Cell volume; MCH= Mean Cell Hemoglobin; MCHC= Mean cell Hemoglobin concentration; PLT= Platelet Count.

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The results in table 4.2 showed the hematological parameters and BMI levels of female geriatrics and control. The results of this study showed that BMI were higher ($p>0.05$) in female geriatrics subjects (24.85±5.68 kg/m^2) when compared with the control subjects (22.52±6.49 kg/m^2). The levels of WBC were lower ($p>0.05$); though not significantly different in female geriatrics (6.03± 1.40 10^{12}/L) as compared to the control (6.50 ± 1.52 10^{12}/L). The levels of lymphocytes were higher ($p>0.05$) in female geriatrics (2.57 ± 0.89 g/dl) as compared to the control (2.82± 0.88 g/dl). The values of granulocytes, packed cell volume, hemoglobin, MCV, MCH, and platelets were not significantly different ($p>0.05$) when the male geriatrics were compared to the control. Red cell count and MCHC were significantly different ($p<0.05$) when geriatrics were compared with the controls.

Table 4.2: Some Hematological Parameters and BMI of Female Geriatrics and their Control Counterparts

PARAMETERS	Geriatrics (n=50)	Control (n=50)	t value	P value
BMI (kg/m^2)	24.85±5.68	22.52±6.49	1.330	0.190
WBC (10^{12}/L)	6.03±1.40	6.50±1.52	-1.121	0.268
LYM (g/dl)	2.57±0.89	2.82±0.88	-1.016	0.315
MID (g/dl)	0.54±0.19	0.63±0.26	-1.431	0.159
GRA (g/dl)	2.76±0.93	3.02±1.06	-0.933	0.356
RBC (10^{12}/L)	4.33±0.69	4.91±1.06	-2.227	0.031
HB (g/dl)	11.78±1.18	12.20±1.85	-0.941	0.352
HCT (%)	37.34±4.46	39.20±5.84	-1.243	0.220
MCV (fL)	84.40±11.48	83.53±15.06	0.224	0.824
MCH (pg/cell)	27.02±4.40	25.48±6.93	0.916	0.364
MCHC (g/dl)	35.27±9.05	27.47±8.70	3.074	0.004
PLT (10^{12}/L)	249.61±52.46	283.15±146.36	-1.041	0.303

Key:

N=Sample Size

P<0.05= Significant

p>0.05=Not Significant

WBC= White blood cell count; LYM=Lymphocytes; MID= Monocytes; GRA; Granulocytes; RBC=Red blood cell count; HGB= Hemoglobin; HCT=Hematocrit; MCV= Mean Cell volume; MCH= Mean Cell Hemoglobin; MCHC= Mean cell Hemoglobin concentration; PLT= Platelet Count.

The results in table 4.3 presented the hematological parameters and BMI levels of male and female geriatrics. The results of this study showed that BMI were lower ($p>0.05$) in male geriatrics subjects (22.94±4.57 kg/m^2) when compared with the female geriatrics (24.85±5.68 kg/m^2). The

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levels of WBC were lower (p>0.05); though not significantly different in male geriatrics (5.02 ± 1.82 10^{12}/L) as compared to female geriatrics (6.03 ± 1.40 10^{12}/L). The levels of lymphocytes were lower (p>0.05) in male geriatrics (2.27 ± 0.66 g/dl) as compared to females (2.57± 0.89 g/dl). The values of granulocytes, hemoglobin, MCV, MCH, MCHC and platelets were not significantly different (p>0.05) when the male geriatrics were compared to the control. Red cell count and packed cell volume were significantly different (p<0.05) when geriatrics was compared with the controls.

Table 4.3: Comparison between Hematological Parameters and BMI of male and female Geriatrics

PARAMETERS	Male Geriatrics (n=50)	Female Geriatrics (n=50)	t value	P value
BMI (kg/m^2)	22.94±4.57	24.85±5.68	-1.314	0.195
WBC (10^{12}/L)	5.20±1.82	6.03±1.40	-1.795	0.079
LYM (g/dl)	2.27±0.66	2.57±0.89	-1.323	0.192
MID (g/dl)	0.53±0.26	0.54±0.19	-0.146	0.885
GRA (g/dl)	2.46±1.22	2.76±0.93	-0.967	0.338
RBC (10^{12}/L)	4.84±0.76	4.33±0.69	2.478	0.017
HB (g/dl)	12.93±2.77	11.78±1.18	1.858	0.069
HCT (%)	41.58±5.75	37.34±4.46	2.874	0.006
MCV (fL)	87.48±8.53	84.40±11.48	1.087	0.282
MCH (pg/cell)	27.09±4.10	27.02±4.40	0.053	0.958
MCHC (g/dl)	34.45±8.23	35.27±9.05	-0.336	0.738
PLT (10^{12}/L)	242.70±94.60	249.61±52.46	-0.311	0.757

Key:

N=Sample Size

P<0.05= Significant

p>0.05=Not Significant

WBC= White blood cell count; LYM=Lymphocytes; MID= Monocytes; GRA; Granulocytes; RBC=Red blood cell count; HGB= Hemoglobin; HCT=Hematocrit; MCV= Mean Cell volume; MCH= Mean Cell Hemoglobin; MCHC= Mean cell Hemoglobin concentration; PLT= Platelet Count.

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DISCUSSION

Ageing is a general physiology process that affects cells and the systems made up of them, as well as tissue components. It is related to a progressive decline in the functional reserve of multiple organ systems increasing the probability of dysfunction and disease.

The result of this study showed that BMI was higher in elderly subjects as compared to the control subjects; though not statistically significant. This is in line with the study by Mariza *et al*. (2007) who reported an increase in BMI of elderly subjects. However, evidence suggests that the risk of finding oneself at the extremes of the body mass index (either underweight or obese), increases along with age (Goulart & Rexrode, 2007). Changes in weight and body composition that occur as we are getting older, have important implications for the health status and functional efficiency of the elderly population (Ritz, 2009; Stanga, 2009). The most obvious changes associated with ageing concern body composition (Stanga, 2009). Ageing is typically associated with a reduction in total and lean body mass. It is generally known that weight increases until approximately 60 years of age and decreases progressively thereafter. Muscle mass declines with age and is gradually replaced by a fat mass. Furthermore, fat location changes over time, with fat mass tending to increase around the abdomen as we age, which can often lead to serious metabolic consequences (Villareal *et al*., 2008). Loss of height is also integrally connected with the ageing process. It is caused by a thinning of the vertebrae, compression of the vertebral discs, development of kyphosis or the effects of osteoporosis. Loss of height occurs in both men and women, although it may develop more rapidly in elderly women due to osteoporosis. It is estimated that loss of height begins at around 30 years of age, leading to a loss of approximately 1 cm per decade until the age of 70, with a loss of 0.5cm per year thereafter (Zamboni *et al*., 2005). The changes in body composition associated with ageing may result in BMI increase of 1.5-2.5 kg/m2 in both men and women, even when body weight remains constant (Lechleitner, 2008). Therefore, the above assertions support the increase in BMI in the elderly subjects.

Also, white blood cell count was lower in the elderly subjects and no significant difference was obtained as male and female geriatrics were compared to their respective controls. However, there was no significant difference in the lymphocyte count, granulocyte count, RBC, MCV, MCH and MCHC of geriatrics subjects. Platelet count was higher in the geriatrics subjects when compared with the control. Hemoglobin concentration was higher while packed cell volume was significantly higher in the geriatrics subjects when compared with the control. This is not in line with the report of Yamada *et al.* (2003) which stated that there is a physiological reduction in normal hematological values as age increases. Also, Nilsson–Ehle *et al*. (1989) reported that Blood hemoglobin (Hb) has, in a number of studies, been reported to decline in the elderly, more so among men than among women and these reports negate the findings of this study. However, the slight reduction of hemoglobin in geriatrics could be an indication of anaemia in the elderly, as there could be a tendency of hemoglobin to drop over time. This is supported by the reports of Mariza *et al*. (2007) who observed anaemia even in the apparently healthy elderly group. A similar study performed by Olivares *et al.* (1994) was conducted in Chile. These authors analyzed 275 apparently healthy individuals older than 60 and found a prevalence of 4% of anaemia in men and 4% in women. This indicates that even in aged people without detectable disease, anaemia may occur. This is in line with the study of Mariza *et al*. (2007) who reported no significant differences

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in hemoglobin levels in the elderly and young adults. This finding agrees with other reports investigating aged people and implies the adequacy of the WHO diagnostic criteria for anaemia, which use the same reference values as young adults.

In addition, the values of hematological parameters observed in this study were in agreement with the World Health Organization (WHO) Criteria for hematological values among the blacks (WHO, 2000). The findings are also in agreement with those reported by Herman (2000), who reported that slight decline in hemoglobin level and other hematological parameters in the elderly men and women does not necessarily indicate disease and that the lower reference limits for both men and women were 11.5g/dl from age 85 years.

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