Original article

Haemtological Parameters of Residents of Offa, KWARA State

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Abstract:

Objectives: This study aims to study some hematologic parameters, here, the packed cell volume (PCV), the red blood cell (RBC) count, hemoglobin concentration (HC) and white blood cell (WBC) count in residents of Offa in Kwara state, Nigeria ***Methods:*** Blood samples of healthy male and female Offa indigenes were analyzed for RBC count, PCV, HC and WBC count. ***Results:*** The mean HC was 14.6 and 13.71 g/dl of blood, for both males and females respectively, while the mean PCV was 43.1% and 40.4% for both males and females, respectively. The mean RBC count for males was 5.45 x 16^6 cells per mm^3 while that of females was 4.55 x 10^6 / mm^3. ***Conclusion:*** All values investigated were lower than that for Caucasians. The probable causes of the differences between the above values as compared to those of the western world were also discussed.

Key word: Haematologic, Offa, PCV, RBC, WBC, Hemoglobin

Introduction

While it is customary to apply the same reference ranges to patients with diverse ancestral origins, it has been known for some time that there are differences, particularly between "normal" values obtained from subjects with European or African ancestry. For example, compared to whites, African-Americans appear to have lower serum transferrin saturation (TS), higher serum ferritin levels[1-3], lower bilirubin levels[4], and lower leukocyte counts[5]. Perhaps most importantly, the average hemoglobin level, hematocrit, and mean corpuscular volume (MCV) are lower in African-Americans than in whites.

Earlier studies documenting the difference in normal hemoglobin levels in African-American men, women, and children compared with their white counterparts were reviewed in detail in 1992 [2] and additional studies have appeared since[6, 7]. Indeed, it has been suggested that different reference ranges need to be considered for these 2 groups[5], but the validity of some of the studies has been challenged[8].

The blood is essentially a suspension of corpuscles or cells in a complex fluid medium known as plasma. The cellular elements are red blood cells, white blood cells and platelets. Plasma is made up of water, electrolytes, nutrients, gases, antibodies. Primarily, blood is a life-sustaining medium.

In the assessment of patients, Nigerian clinicians often have to rely on figures obtained from the western world[9]. Yet it is known that environmental, social and genetic factors play a major role in physiological adjustment[10].

It has also been suggested that because of undernutrition or malnutrition, resulting in decreased production of red blood cells (erythrocytopaenia) and increased loss of blood due to various infections in the tropics, the majority of the population in tropical Africa suffer from some degree of anaemia, which is worse in women and young children[11].

Several studies[12, 13, 14, 15], have shown variations in hematologic parameters between different races and also within the same races but at different geographic locations.

Therefore, there is need for the establishment of normal physiologic data, particularly among healthy Nigerians at different geographic locations. This study, therefore, aims to study some hematologic parameters, here, the packed cell volume (PCV), the red blood cell (RBC) count, hemoglobin concentration (HC) and white blood cell (WBC) count in residents of Offa in Kwara state, Nigeria. These would provide the necessary data in this respect.

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Materials And Methods

Selection criteria

Data was collected from 104 (one hundred and four) healthy Offa indigenes aged between 18-25 years. They consisted of 54 (fifty-four) males and 50 (fifty) females. They were selected form volunteers from the general public from different areas of Offa local government. Selection was based on apparently healthy people who fulfilled the following criteria:

Aged between 18-25 years

No history of recent blood loss

No history of recent drug usage (within 3 months)

No history of blood transfusions in the last 12 months

Additional criteria were included for females as, not being pregnant, not lactating and not menstruating at the period of blood collection. The anthropometric data was also obtained.

Age as provided by subjects was recorded to the nearest birthday. Body weight and height measurement were also taken using a standard weight and height scale.

Blood collection and determination of hematologic parameters

The blood was drawn in the morning between 8 am and 11 am and hematological values were determined within 2 hours of collecting the sample. Red blood cell (RBC) count, packed cell volume (PCV), hemoglobin concentration (HC) and total white blood cell count (WBC)were then determined.

All hematologic parameters were determined by an automated hematological analyzer, Symex KY-21 (Symex Corporation, Japan) using whole blood sample..

Statistical analysis

All results were expressed as mean ± SEM. Data was analysed by one-way analysis of variance (ANOVA) and Duncan New Multiple Range Test (DMRT). Differences in means were considered significant at $P<0.05$. All analysis was performed using SPSS 17. Prior the commencement of this study, the research protocol was approved by the local ethical committee.

Results

Mean values for HC, RBC count, PCV, WBC count were all higher for Offa males than in females. These difference were statistically significant ($p<0.05$) where the lowest single value of any of the variables is always in females, and the highest one is always in males. These are presented in tables I & II below. The comparative values for males and females (Offa Vs Caucasians) are also presented in table III below.

Table I: haematological values of male Offa indigenes (age 18-25 years)

Parameters	RBC (/mm^3)	PCV (%)	HC (g/dl)	WBC (/mm^3)
Mean value	5.45 x 10^6	43.1	14.6	5.83 x 10^3
Standard deviation	287,807	1.7	0.4	333
Standard error of mean	38,892	0.2	0.1	45

RBC- red blood cell PCV- packed cell volume HC- haemoglobin concentration WBC-white blood cell

Table II: haematological values of female Offa indigenes (age 18-25 years)

Parameters	RBC (/mm^3)	PCV (%)	HC (g/dl)	WBC (/mm^3)
Mean value	4.55 x 10^6	40.0	13.71	4.85 x 10^3
Standard deviation	172,750	1.4	0.6	233
Standard error of mean	24,330	0.2	0.1	38.8

RBC- red blood cell PCV- packed cell volume HC- haemoglobin concentration WBC-white blood cell

Table III: Comparative haematological values for Offa indigenes (males/females) and Caucasians

Groups Parameters	Offa males	Caucasian males	Offa females	Caucasian females
RBC (/mm^3)	5.45 x 10^6	5.50x 10^6	4.55 x 10^6	4.82 x 10^6
PCV (%)	43.10	47.00	40.04	42.00
HC (g/dl)	14.60	15.50	13.71	14.00
WBC (mm^3)	5.83 x 10^3	6.42 x 10^3	4.85 x 10^3	5.50 x 10^3

RBC- red blood cell PCV- packed cell volume HC- haemoglobin concentration WBC-white blood cell

DISCUSSION

The study was designed to investigate hematological parameters of residents of Offa, Kwara state, Nigeria in comparison to that of Caucasians.

Offa is a town in Kwara state of Nigeria. The population is between 100,000 and 250,000. It is located on latitude: 8° 10' 33" N' and Longitude: 4° 43' 02" E of the Greenwich Meridian on a plain land. Offa is about 56km from Ilorin; the state capital and 59km from Osogbo, the Osun State Capital. It is located about 600m above sea level which gives it its cool weather condition throughout the year. The people of Offa are mostly farmers, great archers and hunters like their progenitor. Offa is synonymous with sweet potato (*anamo*) which is produced in large quantity along with other food and cash crops.

As modern humans emerged from Africa and encountered new environmental pressures in Europe and Asia, numerous adaptive changes occurred in the gene pool. Some single gene mutations that occur largely among persons with African ancestry, such as the sickle hemoglobinopathy and G6PD deficiency are well known; presumably, these mutations were selected by the pressure exerted by malarial infection. But there are also quantitative differences in the results of various blood tests that are less widely appreciated by physicians and that may influence, at least in some cases, the interpretation of the standard laboratory test used in hematology and other fields of medicine[16].

The blood is an important tissue in man. Hematological parameters are useful in making diagnosis of diseases. The picture of haematological indices is influenced by race, geographical locations, age, environmental factors and prevalence of infectious diseases such as Malaria[17].

The PCV is the volume percentage (%) of red blood cells in the blood. It is considered an integral part of a person's complete blood count result, along with the HC, WBC and platelet count. An estimated haematocrit as a percentage may be derived by tripling the HC and dropping the units. Therefore a single factor affecting anyone of these parameters will indirectly affect the other parameters.

Comparison between the PCV, HC and RBC counts between both males and females of Offa in this study and Caucasian values showed a relative decrease in their values in this study. The decrease noted could be due to under-nutrition which could result in decreased production of RBC, increased blood loss due to various infestations (for example, hookworm and malaria), and protein malnutrition[11, 18].

Studies by Ernest and Carol[16] suggested an ?-thalassemia gene, iron deficiency and higher levels of 2, 3-diphosphoglycerate (which might decrease the erythropoietic drive sufficiently to result in lower hemoglobin levels) in African-Americans could explain these phenomena.

Malaria which is a major health problem in Nigeria accounts for more causes of death than any country in the world[19]. The WHO estimates 216 million cases of malaria occurred in 2010, 81% in the African region. Studies by Ovuakporaye[20], George & Ewwelike[21] have also shown that there is a decrease in PCV, HC and RBC counts in malaria parasitaemia.

Mukherji (2002) also stated that Women in most developing countries are in a state of precarious iron balance, presenting with iron and folate deficiency during their reproductive years. This is mostly due to poor nutrional intake, menstrual blood loss, recurrent parasitic infection (malaria, hookworm) and repeated pregnancies[11].

Another contributing factor could be linked to the diet of Offa indigenes. This consists mostly of tuberous carbohydrates, such as sweet potatoes and yam, and this could lead to deficiencies in protein and iron with subsequent reduction in RBC production. Also being mostly farmers, indigenes of Offa are there predisposed to repeated hookworm infestation which could also lead to anemia.

The range and mean of total WBC count in both healthy male and female Nigerians by Araba[12] showed some correlation with that of the present study. But values of total WBC in both males and females were markedly reduced when compared to that of the western population. This observation is consistent with reports from other studies[22-25].

Peripheral WBC is known to vary among different racial and ethnic groups. WBC is lower among

African Americans when compared to European Americans[26, 27]. Non-genetic factors that influence WBC include smoking, socioeconomic status, systemic inflammatory diseases, and acute infection[28, 29]. However, the difference in WBC between racial and ethnic groups has not been explained by any of these factors. In addition, some studies have demonstrated a familial component to variation in WBC.

Studies by Michael and James *et al* [30] pointed out that the ranges of the expected baseline WBC in individual patients could be inferred genetically in African Americans by genotyping rs2814778 and might help clinicians titrate the dose of these drugs in a more individualized way. They also suggested that further work on this locus should allow for the identification of the causative variant(s) underlying the phenotype and shed light on their biological and clinical implications.

Medical decisions are, of necessity, based on comparing patient values with reference ranges. When these ranges are derived from one population and then applied to another, unnecessary investigations of seemingly aberrant laboratory results may be the consequence. The potential for harm from the latter type of error was recently highlighted in a study comparing African-American and white women with breast cancer. It appeared that one of the reasons why African-Americans may have a less favorable outlook is that treatment is withheld because of lower leukocyte counts[31]. Decisions made by a physician regarding investigation of anemia usually are based on whether the patient's hemoglobin level falls within the accepted reference range. A part of this difference is due to the high prevalence of -thalassemia in the African-American population, but this is not an important practical consideration from the point of view of the physician, since means for routine clinical diagnosis of ?-thalassemia are not available. The problem cannot be solved by simply establishing different ranges for different ethnic groups, especially since all represent some degree of admixture. Thus, it is basically information that the physician must possess that becomes one the many factors that we designate as clinical judgment[16].

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