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# Variation in some Haematological Parameters in Newborns at Different Locations in Delta State, Nigeria.

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**Abstract:**

Haematological parameters in the newborn are commonly used tool to assess the health or disease status of the newborn. These parameters, to a large extent are believed to vary with geographical locations. The aim of this study was to establish the effect of geographical location on some haematological parameters in the newborns at birth. Blood samples were collected at birth from 374 apparently healthy newborns, and their full blood counts was determined using Sysmex KX-21N haematology analyzer. The mean ± standard deviation of red blood cell (4.81 ± 3.69), white blood cell (14.08 ± 6.17), Neutrophil counts (8.31 ± 4.31) and mean platelet volume (10.34 ± 1.25) among newborns delivered in Warri were significantly higher when compared with newborns delivered in Asaba with red blood cell (4.27 ± 0.57), white blood cell (12.61 ± 3.86), Neutrophil counts (6.54 ± 2.55) and mean platelet volume (9.72 ± 0.97). This study revealed significant differences in mean red blood cell counts ($p = 0.0470$), white blood cell counts ($p = 0.0062$), neutrophil counts ($p < 0.0001$) and mean platelet volume ($p < 0.0001$) among newborns in the two study locations. Therefore, the use of uniform reference range in the clinical management of neonates from these locations should be revisited. The understanding of these observed changes in the birthplace of newborns could assist paediatricians and neonatologists in the diagnosis and clinical management of newborns in various localities.

**Keywords**: Newborns, haematological parameters, geographical location.

## Introduction:

Haematological profile in neonates is useful in evaluating the state of health or disease of the newborn. In the medical laboratory, determination of full blood count is a routine haematology investigation for the identification of anaemia, sepsis, thrombocytopenia or any haematological disease that may manifest during the neonatal period (Younis *et al.,* 2017). Following difficulties often encountered in collecting adequate blood specimen for full blood count, the use of cord blood has become a veritable alternative (Lee *et al.,* 2010). The cord blood also has additional advantage of revealing the foetal haematopoiesis as it is enriched with haematopoietic stem cells and progenitors (Younis *et al.,* 2017; Chang *et al*., 2011).

Haematological values in neonatal period are however, readily affected by varying factors such as gender, race, time of blood sample collection, gestational age, birth weight, mode of delivery, geographical location amongst others (El-Gendy *et al.,* 2016; Proytcheva, 2009). For example, a significant difference was observed in the neutrophil count of neonates from vaginal deliveries ($p = 0.0246$), when compared with caesarean deliveries (Adjekuko *et al.,* 2018). Other studies have also revealed that premature neonates have a lower red blood cell count with a shorter cell lifespan, low haemoglobin and haematocrit levels, as well as higher mean cell volume, when compared with term neonates (Proytcheva, 2009).

Occupational exposure to pollutions from oil and gas explorations, petroleum products and fumes have been reported to have toxic effects on various organs and body systems with high impact on the haematopoietic system (Christian *et al.,* 2016 Adienbo *et al.,* 2010). Environmental pollutants have also been reported to cross the placental barrier (Tilley and Fry, 2015) and possibly affect the haematopoietic system of the newborns. Studies have shown that Warri metropolis was more prone to environmental pollutants from toxic metals when compared with Asaba location (Edosomwan *et al.,* 2016; Osakwe *et al.,* 2012; Etchie *et al.,* 2011). A uniformed reference range is often indiscriminately used by healthcare professionals in the clinical management of neonates in Delta State. It has become imperative based on finding from this study to check if there exist any differences in the haematological indices of neonates at different birthplace in order to assist in the diagnosis and management of newborns in various locations in Nigeria. It is believed that the knowledge of these changes could assist paediatricians and neonatologists in the evaluation, diagnosis and management of newborns in these localities. Therefore, this study aims to evaluate variations in haematological indices in cord blood of newborns at Warri, a crude oil exploration city and Asaba the state capital of Delta State.

## Materials and methods

### Study population

This is a hospital based cross-sectional study carried out at Federal Medical Centre, Asaba and Central hospital, Warri respectively in Delta State, Nigeria between April and November 2016. A total of 374 apparently healthy newborns with no systemic illness as certified by the Consultant Paediatrician were included in this study. Out of the 374 newborns, 190 were delivered in Warri consisting of 70 females and 120 males; 44 delivery was through caesarean section, while 146 was through normal vaginal delivery. Their birth weight ranged from 1.4kg – 4.2kg with a mean birth weight of 3.2 ± 0.5 kg. On the other hand, 184 newborns were delivered in Asaba comprising of 86 females and 98 males; 24 newborns were delivered through caesarean section while 160 were normal vaginal deliveries. The birth weights ranged from 1.9kg – 4.7kg with a mean birth weight of 3.1 ± 0.5 kg.

### Exclusion criteria:

All stillbirths and/or newborns delivered before admission into the labour ward were excluded from the study.

**Inclusion Criteria**: Healthy newborns with no systemic illness as certified by the Consultant Paediatrician were included in this study.

### Ethical approval:

The study was approved by the ethical committees of both health institutions (FMC/ASB/28, 20th April, 2016; CHW/ECC VOL1/095, 4th August, 2016), while written informed consent was obtained from the mothers of every newborn prior to delivery and before specimen collection.

### Sample collection and processing

Three milliliters (3mL) of cord blood were collected by well experienced midwives trained in cord blood collection from the umbilical cord of all neonates immediately after delivery, and dispensed into blood bottles containing di-potassium salt of ethylene di-amine tetra-acetic acid ($K_2$ EDTA). Full blood count was determined within 3 hours of sample collection according to manufacturer's instruction using Haematology auto-analyser model of Sysmex KX-21N, manufactured by Sysmex Corporation, Kobe, Japan. Haematological parameters analyzed were, red blood cell (RBC) count, mean cell volume (MCV), packed cell volume (PCV), white blood cell (WBC) count, neutrophil count, lymphocyte count, platelet count, mean platelet volume (MPV). On the other hand, Neutrophil-Lymphocyte Ratio (NLR) was manually calculated as absolute neutrophil count divided by absolute lymphocyte count, and Platelet-Lymphocyte Ratio (PLR) was calculated as Platelet count divided by absolute lymphocyte count.

### Statistical analysis

Haematological profile of the study population was expressed as the mean ± standard deviation (mean ± SD) and Student's t-test was used to compare the means using the statistical software INSTAT® (Graph Pad Inc., La Lolla, CA, USA). The level of significance was set at $p < 0.05$.

**Results:**
Out of the 374 newborns enrolled in this cross-sectional study, 190 (50.8%) newborns were delivered in Central hospital, Warri while 184 (49.2%) were delivered at the Federal Medical Centre, Asaba. Other demographic characteristics of the newborns according to location of study are listed in Table 1.

Table 2 shows the comparison of some haematological parameters among neonates at birth in Warri and Asaba. There was a significantly higher ($p < 0.05$) mean red blood cell count (4.81 ± 3.69), white blood cell count (14.08 ± 6.17), Neutrophil counts (8.31 ± 4.31) and significantly higher ($p < 0.001$) mean platelet volume (10.34 ± 1.25) among the newborns delivered in Warri centre when compared with newborns delivered at the Asaba centre with mean red blood cell count (4.27 ± 0.57), white blood cell count (12.61 ± 3.86), Neutrophil counts (6.54 ± 2.55) and mean platelet volume (9.72 ± 0.97) respectively. However packed cell volume, lymphocytes and platelet counts, mean cell volume, neutrophil-to-lymphocyte ratio and platelet-to-lymphocyte ratio revealed no significant difference ($p > 0.05$).

**Table 1.0: Some sociodemographic data of newborns according to location of study**

| Sociodemographic Parameter | Warri (n=190) | Asaba (n= 184) |
|---|---|---|
| **Gender** | | |
| Male | 120 (63.2%) | 98 (53.4%) |
| Female | 70 (36.8%) | 86 (46.6%) |
| **Mode of Delivery**: | | |
| Caesarean section | 44 (23.3%) | 24 (12.8%) |
| Normal vaginal delivery | 146 (76.7%) | 160 (87.2%) |
| **Birth Weight** | | |
| Birth weight (mean ± SD) (kg) | 3.2 ± 0.5 | 3.1 ± 0.5 |
| Range | 1.4 - 4.2 | 1.9 - 4.7 |

**Table 2: Comparison of some haematological parameters among neonates at birth in Warri and Asaba.**

| Parameters | Warri (n=190) | Asaba (n=184) | P-value |
|---|---|---|---|
| RBC ($10^{12}$/L) | 4.81±3.69 | 4.27±0.57 | 0.0470* |
| PCV (%) | 42.10±11.71 | 41.46±5.10 | 0.4970 |
| WBC ($10^9$/L) | 14.08±6.17 | 12.61±3.86 | 0.0062* |
| Neut ($10^9$/L) | 8.31±4.31 | 6.54±2.55 | <0.0001* |
| Lymph ($10^9$/L) | 4.64±2.50 | 4.62±1.90 | 0.9308 |
| Platelet ($10^9$/L) | 240.29±98.39 | 249.40±67.15 | 0.2978 |
| MCV (fL) | 93.92±9.12 | 96.24±14.22 | 0.0603 |
| NLR | 3.50±16.02 | 1.60±0.84 | 0.1105 |
| PLR | 66.70±42.20 | 64.08±31.29 | 0.5209 |
| MPV (fL) | 10.34±1.25 | 9.72±0.97 | <0.0001* |

** Significant.*
*Key: RBC=Red Blood Cell counts; PCV= Packed Cell Volume; WBC=White Blood Cell counts; Neut=Neutrophil counts; Lymph= Lymphocyte counts; MCV=Mean Cell Volume; NLR= Neutrophil/Lymphocyte Ratio; PLR= Platelet/Lymphocyte Ratio; MPV= Mean Platelet Volume*

**Discussion:**
Haematological parameters in the newborn are commonly used to assess the health or disease status of the newborn and to a large extent, the values of these haematological parameters are believed to be influenced by geographical locations.

From this study, some haematological parameters of the newborns were compared based on the location of their deliveries. Interesting changes in some haematological parameters were observed in the cord blood of the newborns delivered at different study locations. Specifically, we observed that the red blood cell (RBC) counts of the newborns delivered at the Central Hospital Warri were significantly higher ($p < 0.05$) when compared with newborns delivered at the Federal Medical Centre, Asaba (Table 2). This result is however in contrast with earlier reports by Adienbo and Nwafor (2010), who reported a significant decrease in mean red blood cell (RBC) count, packed cell volume (PCV) and haemoglobin (Hb) levels from a similar study in the Niger Delta region. The reason for this difference is not clear, although this study was based on newborns cord blood specimen while the study by Adienbo and Nwafor (2010) reported on adult venous blood samples.

The white blood cell (WBC) counts from this study was significantly higher ($p = 0.0062$) among newborns from Warri when compared with newborns from Asaba. This result is in agreement with previous reports (Egwurugwu *et al*., 2013; Adienbo and Nwafor, 2010). They opined that the increased white blood cell count may be due to response of the myeloid and megakaryocytic stem cells to a continued exposure to gas flares. Some studies have shown that stem cells may have the selective advantage of proliferation and resistance to toxicity of oil and its metabolites. Although this present study did not evaluate the level of environmental pollution between the two geographical locations, the differences observed in the white blood cell count may not be unconnected with the environmental pollutions associated with gas flaring and oil exploration.

There was a significant increase in neutrophil count ($p < 0.0001$) among newborns delivered in Warri when compared with those delivered in Asaba. Again, this is in agreement with the reports by Christian *et al*. (2016) who reported a significant increase in WBC and neutrophil counts among test subjects exposed to petroleum pollution when compared with control subjects.
The mean platelet count of newborns delivered in Warri was lower when compared with newborns in Asaba, however, this difference was not statistically significant ($p = 0.2978$). This finding is also in agreement with report by Christian *et al*. (2010). However, the mean platelet volume (MPV) of newborns delivered in Warri was significantly higher ($p < 0.0001$), when compared with newborns in Asaba. An increase in mean platelet volume (MPV) may indicate the release of large platelets into circulation following platelet destruction or utilization (Kotwal, 2014). The reason for the significant increase in MPV among newborns in Warri remains unclear but may be attributed to the release of immature large platelets in response to the low platelet counts recorded among these newborns.

**Conclusion:**
There are significant differences in the white blood cell counts, red blood cell counts, neutrophil counts and mean platelet volume among newborns in the two study locations in Delta state, south-south Nigeria. The use of uniform reference range in the clinical management of neonates from these locations should therefore be reconsidered, as an understanding of these observed changes in the newborns could assist paediatricians and neonatologists in the diagnosis and clinical management of newborns in these localities.

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**Conflict of Interest**:
There is no conflict of interest regarding this work among the authors.

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