**Introduction**

Anemia is caused by:
- Blood loss from parasites
- Ineffective red blood cell (RBC) production from deficiencies of iron, vitamin A, folic acid (FA), vitamin B12 (B12)
- Decreased RBC production from chronic inflammatory disease (CID)
- RBC hemolysis
- Genetic abnormality.

Mean corpuscular volume (MCV) is:
- Decreased in iron deficiency
- Increased with deficiencies of FA, B12
- Normal in CID anemia

Zinc protoporphyrin (ZPP): Accumulates within iron-deprived erythrocytes

ZPP/heme ratio (ZPP/H): Detects iron depletion before anemia occurs.
Is more reliable than transferrin receptor when malaria is present.

**Objective:**

To determine if ZPP/H is a good indicator of iron depletion in drug naïve asymptomatic HIV-infected rural Kenyan women who are of reproductive age and enrolled in a randomized nutrition intervention field study that will determine the impact of added meat, soy or wheat protein on iron status.

**Methodology:**

**Population**
- Drug naïve HIV-infected women of reproductive age
- Asymptomatic, (WHO Stage 1 or 2; CD4 cell count > 250 cells/μL)
- Enrolled as patients in the USAID Academic Model Promoting Access to Healthcare Partnership (USAID-AMPATH) and living in Turbo Division, Kenya.

**Specimen collection and analysis**

Hemoglobin (HB), hematocrit (HCT), MCV, red cell width (RDW) and ZPP/H were determined from fresh blood samples obtained from patients in the field clinic and transported 40 kilometers to the AMPATH reference laboratory where they were processed and analyzed.

ZPP was assessed using a hematofluorometer (Aviv Biomedical, Lakewood, NJ). Red blood cells were washed three times with saline. Low, medium and high controls obtained from Aviv were run daily before and after samples (CV 13.0% for low control, 5.9% for middle control and 3.8% for high control).

<table>
<thead>
<tr>
<th>ZPP/H (umol/mol)</th>
<th>Iron status</th>
<th>N (%)</th>
<th>HB (mg/dl)</th>
<th>HCT (%)</th>
<th>MCV (fl)</th>
<th>RDW (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 60 normal</td>
<td>normal</td>
<td>61(44)</td>
<td>12.7 (1.6)**</td>
<td>39.5 (3.8)**</td>
<td>86.9 (7.6)**</td>
<td>13.4 (1.6)*</td>
</tr>
<tr>
<td>60-80 possible iron depletion</td>
<td>34 (24)</td>
<td>12.4 (1.4)</td>
<td>38.3 (2.9)**</td>
<td>85.3 (7.4)*</td>
<td>14.3 (2.4)**</td>
<td></td>
</tr>
<tr>
<td>&gt; 80 iron depletion</td>
<td>44 (32)</td>
<td>12.1 (1.7)**</td>
<td>33.9 (4.1)*</td>
<td>76.9 (10.0)*</td>
<td>15.7 (2.5)*</td>
<td></td>
</tr>
</tbody>
</table>

Results were grouped by ZPP/H (umol/mol): normal, possible iron depletion, iron depletion and mean HB, HCT, MCV, RDW were compared between the groups.

**Results:**

ZPP/H correlated (p<0.001) with HCT (r - 0.58), MCV (r - 0.49) and RDW (r - 0.49).

**Conclusions and Recommendations:**

- ZPP/H appeared to be a good indicator of iron depletion when compared to HCT, MCV and RDW in this population of drug naïve HIV-infected rural Kenyan women,
- ZPP/H may be useful to differentiate iron depletion from other anemias, especially in individuals with malaria.
Key References


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