**Haematology Reference Ranges**

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| Review Interval | 2 years or as required |
| Location of Hardcopies | Cross site document-Electronic copy only(access via laboratory handbook website and Q pulse) |

**Changes from last version of this document**

Changed title of document to Haematology Reference Ranges, as it now also contains ESR reference ranges. Added normal range for immature granulocytes

**Background**

Areference range or reference interval is the range of values that is deemed normal for a physiological measurement in healthy persons.

The standard definition of a reference range for a particular measurement is defined as the interval between which 95% of values of a reference population fall into, in such a way that 2.5% of the time a value will be less than the lower limit of this interval, and 2.5% of the time it will be larger than the upper limit of this interval, whatever the distribution of these values.

**Normal ranges in adults**

Reference ranges have been verified based on the local population. A sample of over 500 normal results was gathered and a mean and standard deviation for each parameter was obtained. Any outliers (>3.0 SD) were removed, and an upper and lower limit were obtained by calculation of the 2.5 and 97.5 percentile. This data is stored on Q pulse HA-INF-REFHAEM DATA.

For the reticulocyte normal range, results from over 3500 patients were gathered and a range established as detailed above. This data is stored on Q pulse HA-INF-REFRETIC DATA

Our reference ranges were compared against published literature providing ranges established by national and/or international consensus 1, 2 . In order to provide a harmonised normal range between York and Scarborough a lymphocyte range of 0.5-4.0 was selected.

All requests sent to the lab with no age or sex, may be entered as unknown, and therefore will be allocated an adult female reference range.

All reference ranges are to 1 decimal place.

The pregnancy Haemoglobin (Hb) reference range was taken from the BCSH guidance and agreed by the Consultant for Obstetrician and Gynaecologist for all women marked as pregnant.

**Normal ranges in infants and children**

Due to issues surrounding generation of internal ranges due to lack of available data; reference ranges for children are wholly derived from several published sources 1, 2, 3

**ESR reference ranges1**

In healthy subjects, the erythrocyte sedimentation rate (ESR) is higher in women than in men, and in both sexes, a rise occurs with age.

| **erythrocyte sedimentation rate (ESR)** |
| --- |
| **Age (years)** | **Male** | **Female** | **Units** |
| **17–50**  | ≤ 10 | ≤ 12 | mm/hr |
| **51–60**  | ≤ 12 | ≤ 19 | mm/hr |
| **61–70**  | ≤ 14 | ≤ 20 | mm/hr |
| **>70**  |   ≤ 30    | ≤ 35 | mm/hr |

**References**

1. Practical Haematology, 11th edition 2012, Dacie & Lewis.
2. Blood Cells-A Practical Guide, 4th edition, 2006, Barbara J Bain.
3. Pediatric Haematology, 3rd edition 2006 Robert J. Arceci *et al*
4. HA-INF-REFHAEM DATA
5. HA-INF-REFRETIC DATA
6. BCSH: UK guidelines on the management of iron deficiency in pregnancy, 2011

**Adult Full Blood Count Reference Ranges 4**

| **Test** | **Male** | **Female** | **Units** |
| --- | --- | --- | --- |
| **Haemoglobin (Hb)** | 130 - 180 | 115 – 165 *(Pregnant 105 – 165)*6 | g/l |
| **White Blood Cell (WBC)** | 4.0 – 11.0 | 4.0 – 11.0 | x 109/l |
| **Platelets (Plt)** | 150 - 450 | 150 - 450 | x 109/l |
| **Red Blood Cell (RBC)** | 4.3 - 5.8 | 3.9 - 5.4 | x 1012/l |
| **Mean Cell Volume****(MCV)** | 80 - 100 | 80 - 100 | fl |
| **Haematocrit (Hct or PCV)** | 0.39 - 0.5 | 0.36 - 0.47 | l/l |
| **Mean Cell Haemoglobin (MCH)** | 27 - 32 | 27 - 32 | pg |
| **Mean Cell Haemoglobin Concentration (MCHC)** | 300 - 360 | 300 - 360 | g/l |
| **Neutrophils (neut)** | 2.0 – 8.0 | 2.0 – 8.0 | x 109/l |
| **Lymphocytes (Lymph)** | 0.5 – 4.0 | 0.5 – 4.0 | x 109/l |
| **Monocytes (mono)** | 0.2 - 1.2 | 0.2 - 1.2 | x 109/l |
| **Eosinophils (Eos)** | 0.1 - 0.5 | 0.1 - 0.5 | x 109/l |
| **Basophils (Baso)** | 0.0 - 0.1 | 0.0 - 0.1 | x 109/l |
| **Reticulocytes (retic) 5** | 20-100 | 20-100 | x 109/l |
| **Ret-He** **(RETICULOCYTE Hb EQUIVALENT)** | >28.0 | >28.0 | pg |
| **%HYPOCHROMIC RBC** | 0.1 – 6.5 | 0.1 – 6.5 | % |
| **IMMATURE GRANULOCYTES (IG)** | 0.0 – 0.2 | 0.0 – 0.2 | x 109/l |

**Paediatric Full Blood Count Reference Ranges**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Age** | **Hb** | **RBC** | **Hct** | **MCV** | **MCH** | **MCHC** | **WBC** | **Neut** | **Lymph** | **Mono** | **Eos** | **Baso** | **Plt** | **Retic** |
| **(g/l)** | **(x1012/l)** |  **(l/l)** | **(fl)** | **(pg)** | **(g/l)** | **(x109/l)** | **(x 109/l)** | **(x 109/l)** | **(x 109/l)** | **(x 109/l)** | **(x 109/l)** | **(x 109/l)** | **(x 109/l)** |
| **Birth1** | 140 – 220 | 5.0 – 7.0 | 0.45-0.75 | 100 –120 | 31 - 37 | 300 - 360 | 10.0 – 26.0 | 4.0 – 14.0 | 3.0 – 8.0 | 0.5 – 2.0 | 0.1 – 1.0 | 0.0 - 0.1 | 100 – 450 | 120 - 400 |
|
| **3 Days1** | 150 - 210 | 4.0 – 6.6 | 0.45–0.67 | 92 - 118 | 31 - 37 | 290 - 370 | 7.0 – 23.0 | 3.0 – 5.0 | 2.0 – 8.0 | 0.5 – 1.0 | 0.1 – 2.0 | 0.0 – 0.1 | 210 - 500 | 50 - 350 |
| **7 Days1** | 135 - 215 | 3.9 – 6.3 | 0.42–0.66 | 88 - 126 | 31 - 37 | 280 - 380 | 6.0 – 22.0 | 3.0 – 6.0 | 3.0 – 9.0 | 0.1 – 1.7 | 0.1 – 0.8 | 0.0 – 0.1 | 160 - 500 | 50 - 100 |
| **2 wks1** | 125 – 205 | 3.6 – 6.2 | 0.31–0.71 | 86 - 124 | 31 - 37 | 280 - 380 | 6.0 – 22.0 | 3.0 – 7.0 | 3.0 – 9.0 | 0.1 – 1.7 | 0.1 – 0.9 | 0.0 - 0.1 | 170 – 500 | 50 - 100 |
| **1 mth1** | 115 – 165 | 3.0 – 5.4 | 0.30–0.53 | 92 – 116 | 30 - 36 | 290 - 370 | 5.0 – 19.0 | 3.0 – 9.0 | 3.0 – 16.0 | 0.3 – 1.0 | 0.2 – 1.0 | 0.0 - 0.1 | 200 – 500 | 20 - 60 |
|
| **2 mths1** | 94 – 130 | 3.1 – 4.3 | 0.28–0.42 | 87 – 103 | 27 - 33 | 285 - 355 | 5.0 – 15.0 | 1.0 – 5.0 | 4.0 – 10.0 | 0.4 – 1.2 | 0.1 – 1.0 | 0.0 - 0.1 | 210 – 650 | 30 - 50 |
|
| **3-6 mths1** | 111 – 141 | 4.1 – 5.3 | 0.30–0.40 | 68 - 84 | 24 - 30 | 300 - 360 | 6.0 – 18.0 | 1.0 – 6.0 | 4.0 – 12.0 | 0.2 – 1.2 | 0.1 – 1.0 | 0.0 - 0.1 | 200 – 550 | 40 - 100 |
|
| **1 yr1** | 111 – 141 | 3.9 – 5.1 | 0.30–0.38 | 72 - 84 | 25 - 29 | 320 - 360 | 6.0 -16.0 | 1.0 - 7.0 | 3.5 – 11.0 | 0.2 – 1.0 | 0.1 – 1.0 | 0.0 - 0.1 | 200 – 550 | 30 - 100 |
| **2-6 yrs3** | 110-140 | 4.0 - 5.2 | 0.34–0.40 | 75 –87 | 24 –30 | 310 – 370 | 5.0 – 15.0 | 1.5 – 8.5 | 1.8 – 8.4 | 0.2 – 1.0 | 0.1 – 1.0 | 0.0 - 0.1 | 200 – 490 | 30 - 100 |
| **6-12 yrs1** | 115 – 155 | 4.0 – 5.2 | 0.35–0.45 | 77 - 95 | 25 - 33 | 310 - 370 | 5.0 – 13.0 | 2.0 – 8.0 | 1.0 – 5.0 | 0.2 – 1.0 | 0.1 – 1.0 | 0.0 - 0.1 | 170 – 450 | 30 - 100 |
| **12-18 yrs (Female)2** | 113-154 | 4.0 - 5.1 | 0.35-0.46 | 77- 94 | 25 - 33 | 310 - 370 | 4.0 - 11.0 | 1.5 - 7.0 | 1.5 - 4.0 | 0.2 – 1.3 | 0.1 – 0.8 | 0.0 - 0.1 | 150 - 450 | 20-100 |
| **12-18 yrs (Male)2** | 115 -170 | 4.2 – 5.8 | 0.36–0.49 | 77 - 96 | 25 - 33 | 310 - 370 | 4.0 - 11.0 | 1.5 - 7.0 | 1.5 - 4.0 | 0.2 – 1.3 | 0.1 – 0.8 | 0.0 - 0.1 | 150 - 450 | 20-100 |