



HEALTH HOLDING

HAFER ALBATIN HEALTH  
CLUSTER  
MATERNITY AND  
CHILDREN HOSPITAL

<b>Department:</b>	Laboratory and Blood Bank		
<b>Document:</b>	Internal Policy and Procedure		
<b>Title:</b>	Reference Ranges and Abnormal Values		
<b>Applies To:</b>	All Hematology Staff		
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## 1. PURPOSE:

1.1 A reference range for a population can be established from measurement on a relatively small number of subjects (40 or 120 or more is preferable) if they are assumed to be representative of the population as a whole.

## 2. DEFINITONS:

N/A

## 3. POLICY:

3.1 The data supplied is meant to supplement rather than replace consultation with senior staff members and we welcome inquiries that assist the physicians in the diagnosis and management of patients. The reference range by definition means 95% of the population; therefore 1 of any 20 individuals may fall outside this range. The probability of finding a disease is related to positive predictive values of the tests along with the incidence of disease in a given population.

## 4. PROCEDURE:

### 4.1 The condition for obtaining samples from the individuals must be standardized and data should be analyzed separately for different variables such as:

- 4.1.1 Individuals in bed
- 4.1.2 Or ambulant.
- 4.1.3 Smokers or non-smokers
- 4.1.4 The samples should be collected at about the same time of day before breakfast.
- 4.1.5 The last meal should have been eaten not later than 9 p.m. on the previous evening.

### 4.2 Statistical procedure:

- 4.2.1 The data will fit either symmetric (Gaussian) or asymmetric (non- Gaussian) pattern.
- 4.2.2 In the Gaussian distribution, the arithmetic:
  - 4.2.2.1 Mean ( $x$ ): the sum of all the measurements ( $\Sigma$ ) divided by the number of measurements ( $n$ ).
  - 4.2.2.2 Median ( $m$ ): the point on the scale that has an equal number of observations above and below.
  - 4.2.2.3 Mode: is the most frequently occurring result. Gaussian distribution: describes data or events which occur symmetrically about the Mean. With this type of distribution, mean, median and mode will be approximately equal. Standard deviation (SD): is the extent of spread of measurements about the mean.

4.2.2.4 Variance: is the difference between every value and the mean:

$$\text{Variance } (S^2) = \frac{\sum (x - \bar{x})^2}{n - 1}$$

Standard deviation (SD) =  $\sqrt{S^2}$  68% of all measurements will be within  $\pm 1\text{SD}$  range, 95% within  $\pm 2\text{SD}$ , and 99% within  $\pm 3\text{SD}$ .

## 5. MATERIAL AND EQUIPMENT:

N/A

## 6. RESPONSIBILITIES:

- 6.1 All Hematology Staff

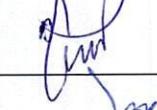
## 7. APPENDICES:

- 7.1 CBC Reference Range
- 7.2 Coagulation Tests Reference Range

## 8. REFERENCES:

- 8.1 McPherson RA and Pincus MR. Henry's Clinical Diagnosis and Management by Laboratory Methods.

## 9. APPROVALS:

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## APPENDIX 7.1: CBC Reference Range

Parameter	Units	Adult-Male	Adult-Female	Newborn	Infant, 1 yr:	Children 2-6 yr :	Children 6-12 yr:
WBC	$10^3 / \mu\text{L}$	4.0 – 11.0	4.0 – 11.0	10.0 – 26.0	6.0 – 16.0	5.0 – 15.0	5.0 – 13.0
RBC	$10^6 / \mu\text{L}$	4.5 – 5.5	3.8 – 4.8	5.0 – 7.0	3.9 – 5.1	4.0 – 5.2	4.0 – 5.2
HGB	G/dL	13 – 17	12 – 16	14.0 – 22.0	11.1 – 14.1	11.0 – 14.0	11.5 – 15.5
HCT	%	40-50	36 – 46	45 – 75	30 – 38	34-40	35 – 45
MCV	fL	80 – 97	80 – 97	95 – 122	72 – 84	75 – 87	77 – 95
MCH	pG	27 – 32	27 – 32	31 – 37	25 – 29	24 – 30	25 – 33
MCHC	g/dL	32 – 36	32 – 36	30 – 36	32 – 36	31 – 37	31 – 37
PLT	$10^3 / \mu\text{L}$	150 – 400	150 – 400	100 – 450	200 – 550	200 – 490	170 – 450
NEU	count $\times 10^3 / \mu\text{L}$ and %	2.0-7.0 (40-80%)	2.0-7.0 (40-80%)	4.0-14.0 (19 – 62%)	1.0-7.0 ( 15 – 42 % )	1.5 – 8.0 ( 13 – 33%)	2.0-8.0 ( 37 – 70%)
LYM	count $\times 10^3 / \mu\text{L}$ and %	1.0-3.0 (20- 40%)	1.0-3.0 (20- 40%)	3.0-8.0 (26 – 46%)	3.5-11 ( 36 – 56%)	6.0-9.0 ( 46 – 76%)	1.0-5.0 (10 – 40%)
MONO	count $\times 10^3 / \mu\text{L}$ and %	0.2-1.0 (2-10%)	0.2-1.0 (2-10%)	0.5-2.0 ( 0 – 9%)	0.2-1.0 (0-9%)	0.2-1.0 (0-10%)	0.2-1.0 (0-12%)
EOSI	count $\times 10^3 / \mu\text{L}$ and %	.02-0.5 (1-6%)	.02-0.5 (1-6%)	0.1-1.0 (0 – 4%)	0.1-1.0 (0 – 4%)	0.1-1.0 (0 – 6%)	0.1-1.0 (0 – 7%)
BASO	Count $\times 10^3 / \mu\text{L}$ and %	0.02-0.1 (<1 – 2%)	.02-0.1 (<1 – 2%)	0.02-0.1 (0 – 1%)	0.02-0.1 (0 – 1%)	0.02-0.1 (0 – 1%)	0.02-0.1 (0 – 1%)
ESR	mm / 1 <sup>st</sup> Hr	0 – 10	0 – 20	0-2	3-13	3-13	3-13
Reticulocyte	%	0.5 – 2.5	0.5 – 2.5	2-4.8	0.8 – 2	0.8- 2	0.8 – 2.2

## APPENDIX 7.2: Coagulation Tests Reference Range

Coagulation tests	Adult Reference Range
PT ( sec)	11-14.5
INR%	0.80-1.20
APTT (sec)	26-40
FIBRINOGEN mg/dl	200-400 increase during pregnancy
FACTOR II%	70-120
FACTOR V %	70-120
FACTOR VII %	55-170
FACTOR VIII %	60-150
FACTOR IX%	60-150
FACTOR X %	70-120
FACTOR XI %	60-150
FACTOR XII %	60-150
STA- STACHROM PROTEIN C %	70-130
STACLOT PROTEIN S %	55-140
D dimer / $\mu$ g/ml	0.05-0.42 (< 0.5)
STA-STACHROM ANTITHROMBIN III %	80-120
STA-LIATEST Vwf :ag %	50-160