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MEAN HAEMATOLOGICAL VALUES IN HEALTHY INFANTS AND PRE-SCHOOL CHILDREN IN CAPE TOWN*

PHILIP LANZKOWSKY, M.D. (CAPE TOWN)†, *Department of Child Health, University of Cape Town and Red Cross War Memorial Children's Hospital, Rondebosch, Cape*

Routine haemoglobin estimations determined in the out-patient department of the Red Cross War Memorial Children's Hospital revealed very low haemoglobin levels in many Cape Coloured and African infants and children. Further haematological investigations showed that this low haemoglobin level was usually a manifestation of iron-deficiency anaemia. Treatment of these cases with iron resulted in considerable clinical improvement in their condition and return to the normal blood picture.

In South Africa there has been, so far, no publication on haemoglobin levels in White, Cape Coloured or African infants or pre-school children. The only available reports deal solely with schoolchildren. In other countries there have been many reports of extensive investigations of haemoglobin levels in infants and pre-school children.

In view of the remarkable frequency of low haemoglobin levels in infants and children attending hospital in Cape Town, and the absence of any data on 'healthy' subjects, an investigation was conducted aimed at establishing mean haemoglobin levels in 'healthy' neonates, infants and pre-school children in the three main racial groups in Cape Town.

Material

Haemoglobin levels were determined in a series of 2,365 apparently healthy neonates, infants and pre-school children, whose ages ranged from birth to 7 years. In this series there were 610 White, 1,018 Cape Coloured and 737 African. The infants examined in the first 96 hours of life were born at a number of maternity institutions attached to the University of Cape Town. All older children were drawn from the clientèle of City Council and Divisional Council infant and child welfare clinics and immunization centres and of day crèches and orphanages—all in Cape Town and its environs. All infants and children were apparently healthy and, so far as could be ascertained, had not been given any oral iron supplements.

The nutritional status of these apparently healthy infants and pre-school children, as judged by mean body weights, was better than the average in their respective racial groups. In a sample of 1,253 infants, 39·5% of White, 59·4% of Cape Coloured and 73·7% of African were breast fed up to at least the end of the third month of age.

The socio-economic status of the children was assessed by determining the mean weekly income of the head of the family. On this basis, the White infants and children came from the 'low income' group in the White community, and the Cape Coloured and African children came from the 'medium income' groups in their respective communities.

As a precaution against possible misinterpretation of the results a small group was investigated in detail. Packed cell volumes, mean corpuscular haemoglobin concentrations, and erythrocyte sedimentation rates were determined and blood smears were examined in 35 consecutive infants and children in the Cape Coloured group.

Methods

All blood specimens were collected and estimations made between the hours of 2 and 4 in the afternoon and in the period April and May 1958.

Blood for haemoglobin was taken from the heel of infants and the thumb of older children. A triangular cutting needle was used, and free unrestricted flow without necessity for external pressure of any kind was obtained in all cases. The haemoglobin was estimated by the oxyhaemoglobin method with a Klett-Summerson colorimeter previously calibrated for the purpose against standard haemin and cyanmethaemoglobin solutions.

Blood for the estimation of packed cell volumes and erythrocyte sedimentation rates was taken from the internal jugular vein. Packed cell volumes were estimated by the standard Wintrobe procedure and erythrocyte sedimentation rates were determined by the Westergren method.

Blood smears were stained by the May-Grunewald Giemsa method.

Results

The mean haemoglobin levels and the 95% confidence levels in apparently healthy neonates, infants and pre-school children up to 7 years of age in the three main racial groups are shown in Table I.

The high haemoglobin level at birth and the subsequent fall in level was demonstrated in all three racial groups.

In the first 96 hours of life the mean haemoglobin level was highest in the White infants and lowest in the African infants, the mean level for the Cape Coloured infants occupying a position intermediate between the two.

From 96 hours until the 7th year the mean haemoglobin levels in the White infants and children at all ages were higher than in the Cape Coloured, the mean level for the African infants and children lying between the two (except at 5 - 7 months of age).

The lowest mean haemoglobin values recorded in all three racial groups were found between the 1st and 2nd years of age, after which the level in each racial group rose gradually until the 7th year.

Table II shows, in the various age groups, the percentage of infants and children in this investigation in whom the haemoglobin values were below certain specified levels. Whichever of these levels is chosen as the critical value for anaemia, the percentage of anaemic infants and children in the various ages and racial groups can be determined readily from this table.

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TABLE I. COMPARISON OF MEAN HAEMOGLOBIN VALUES WITH 95% CONFIDENCE LEVELS IN APPARENTLY HEALTHY WHITE, CAPE COLOURED AND AFRICAN INFANTS FROM BIRTH TO SEVEN YEARS

Age	White			Cape Coloured			African		
	Number of Cases	Mean g.%	95% Confidence Level	Number of Cases	Mean g.%	95% Confidence Level	Number of Cases	Mean g.%	95% Confidence Level
1st 12 hours	17	19·88	±1·18	27	19·81	±0·63	16	18·94	±0·98
13-24 hours	17	18·89	±1·21	50	18·67	±0·59	19	18·48	±1·04
72-96 hours	30	18·75	±0·76	67	18·34	±0·59	30	17·71	±0·63
1st month	21	16·30	±1·27	35	14·44	±0·58	37	14·85	±0·52
1-2 months	30	13·80	±0·93	50	12·10	±0·19	56	12·15	±0·40
2-3 months	33	12·03	±0·72	64	10·45	±0·28	46	11·10	±0·42
3-4 months	58	11·09	±0·24	47	10·27	±0·32	46	10·83	±0·35
4-5 months	25	12·04	±0·62	52	10·35	±0·40	52	10·82	±0·35
5-6 months	16	11·29	±0·72	79	10·75	±0·26	49	10·57	±0·30
6-7 months	18	11·12	±0·76	52	10·35	±0·28	43	10·29	±0·42
7-8 months	17	10·89	±0·71	55	10·14	±0·31	28	10·40	±0·34
8-9 months	18	11·41	±0·51	61	9·72	±0·34	30	10·03	±0·47
9-10 months	21	11·08	±0·62	37	9·80	±0·43	22	10·15	±0·43
10-11 months	11	11·14	±1·35	20	9·81	±0·64	17	9·87	±0·54
11-12 months	8	11·20	±0·75	18	9·57	±0·85	17	9·84	±0·69
1-2 years	44	10·58	±0·47	52	9·31	±0·44	59	9·76	±0·38
2-3 years	37	11·63	±0·42	45	10·13	±0·41	47	10·61	±0·43
3-4 years	51	12·10	±0·39	63	10·59	±0·25	45	10·63	±0·30
4-5 years	41	12·23	±0·44	62	11·00	±0·22	31	11·12	±0·45
5-6 years	47	12·10	±0·36	48	11·03	±0·31	36	11·18	±0·33
6-7 years	50	12·35	±0·34	34	11·19	±0·36	11	11·82	±0·11
Totals	610			1,018			737		

The magnitude of the reliability figures varies with the size of the group under consideration and shows the range within which, with 95% probability, the true population mean lies. It is clear that in most instances the larger the sample the smaller is this range.

TABLE II. PERCENTAGE INCIDENCE OF APPARENTLY HEALTHY WHITE, CAPE COLOURED AND AFRICAN INFANTS AND PRE-SCHOOL CHILDREN, IN VARIOUS AGE GROUPS, BELOW CERTAIN SPECIFIED LEVELS OF HAEMOGLOBIN

Age	White	Cape Coloured	African	White	Cape Coloured	African	White	Cape Coloured	African
		<15 g.%			<16 g.%			<17 g.%	
First 12 hours	—	—	6·3	0	0	6·3	5·9	3·7	12·5
13-24 hours	—	4·0	0	0	10·0	10·5	17·6	18·0	26·3
72-96 hours	—	2·0	0	0	9·0	13·3	23·3	15·0	40·0
		<12 g.%			<13 g.%			<14 g.%	
1st month	4·8	8·6	0	9·6	17·1	16·2	9·6	34·3	24·3
1-2 months	16·7	46·0	48·1	39·9	70·0	74·9	63·2	90·0	91·0
		<9 g.%			<10 g.%			<11 g.%	
2-3 months	0	12·5	6·6	6·1	28·1	21·8	30·3	73·4	39·2
3-4 months	0	6·4	4·4	6·9	44·7	17·4	48·3	78·7	63·1
4-5 months	0	13·4	7·7	8·0	34·6	25·0	20·0	69·2	53·9
5-6 months	0	5·1	6·1	18·8	26·6	20·4	43·8	57·0	69·4
6-7 months	10·2	7·7	18·6	16·7	40·5	39·5	33·4	67·4	65·1
7-8 months	5·9	14·6	7·1	23·6	52·7	21·4	47·1	74·5	78·5
8-9 months	—	27·8	13·3	0	52·5	53·4	33·3	85·3	80·1
9-10 months	0	29·7	18·2	28·6	51·3	36·4	42·9	78·4	86·4
10-11 months	9·1	20·0	23·5	18·2	55·0	58·8	36·4	80·0	82·3
11-12 months	—	38·9	29·4	0	55·6	52·9	62·5	77·7	82·4
		<10 g.%			<11 g.%			<12 g.%	
1-2 years	29·5	65·4	59·3	59·0	86·6	81·3	88·5	98·1	94·9
2-3 years	5·4	35·5	32·0	21·6	68·8	53·3	62·1	75·5	87·3
3-4 years	5·9	22·3	33·3	19·6	65·2	62·2	39·2	92·2	88·9
4-5 years	4·9	11·3	16·1	17·1	48·4	35·5	36·6	83·9	77·4
5-6 years	6·4	20·8	5·6	14·9	43·7	44·5	44·7	83·3	75·0
6-7 years	2·0	14·7	0	12·0	35·3	9·1	30·0	73·5	63·6

This incidence is found to be very high in almost all age groups. The incidence is higher in the non-White races than in the White. Comparison of these results with those found in the literature reveals that the incidence of anaemia in the non-White racial groups in Cape Town today is greater than that found in infants and children in a poor community in North East Scotland 25 years ago.

The mean haemoglobin level of breast-fed infants was found to be higher than that of artifically-fed infants but the difference was not statistically significant. No statistically significant sex difference was found in the mean haemoglobin levels either in the infants or pre-school children.

In the 35 consecutive healthy Cape Coloured infants and children in whom more detailed haematological studies were made, the findings were as follows:

1. The mean haemoglobin level was 10·46 g.% (S.D: 0·99).
2. The mean packed cell volume was 37·4% (S.D: 2·97).
3. The average mean corpuscular haemoglobin concentration was 27·98% (S.D: 1·68). This was calculated on the basis of the two preceding values.
4. The erythrocyte sedimentation rate determinations were within the normal range.
5. Blood smears showed that in many the red blood corpuscules were normal in morphology, while others showed all gradations of the iron-deficiency anaemia pattern.

SUMMARY AND CONCLUSIONS

1. In the defined group of Cape Town infants and children ranging from the newborn up to 7 years old, the incidence of anaemia is found to be very high in almost all age groups. The incidence is higher in the non-White races than in the White, and higher in the Cape Coloured than in Africans.

2. These haemoglobin values are lower than the usually accepted normal haemoglobin levels for healthy infants and children in other countries.

3. The more detailed blood studies on the sample of 35 consecutive Cape Coloured infants and children indicate that this low haemoglobin level is a manifestation of widespread iron-deficiency anaemia amongst otherwise healthy infants and pre-school children in the three main racial groups in Cape Town.