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Haemoglobin Levels in Mid-Western Nigeria

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INTRODUCTION

The estimation of haemoglobin formed a part of the clinical examination during the recent nutritional studies of Mid-Western Nigeria, and it was performed in Unoghovo and Ibusa village communities, in August of 1966.

Haemoglobin estimation is now of more than local clinical importance, since the results are being taken as an index of nutrition in national and international surveys. Some degree of reduction of haemoglobn level is invariably observed in persons who have undergone prolonged semistarvation. In the Minnesota Starvation Experiment [1], the diet was not deficent in iron but there was a progressive reduction of haemoglobin level in every subject during the test. Beginning with an average of 15.1±0.88 grams per 100 ml. of blood in the control period, the average value declined to 12.6±0.80 grams after 12 weeks of semistarvation, and to 11.7±0.80 grams at 24 weeks when the weight loss was 24 pre-cent.

The United States Interdepartmental Committee on Nutrition for National Defence (ICNND)+, suggested in the Mannal for Nutrition Surveys [2] that impaired nutriture should be suspected if more than 3% of an adult male population has haemoglobin levels of 12 grams per 100 ml, or less, at sea level.

Low haemoglobin concentration alone should not be the criterion for diagnosis of iron deficiency without further characterization of the anaemia. However, in suspected cases the haemoglobin level is evaluated early in the examination. Haemoglobin level is also not only in the identification of anaemia, but in its classification. Sometimes it is the only measurement that is made, and the result may be used as indication of the necessity for a more extensive haemotological examinations.

There is probably no one method of haemoglobin estimation has been generally accepted as both accurate and convenient. To be simple, the haemoglobin estimation must depend on the visual comparison of colours such as Tallqvist or Sahli methods which may involve serious inaccuracy. To be satisfied that the calibration remains valid for the instrument, reagents and technical routines in use in the laboratory, and one should periodically undertake a precise and time consuming series of standardization. Among the forms of haemoglobin, cyanmethaemoglobin has outstanding advantages. It has been shown that solutions of this pigment are stable for years when they are preserved at referigerator temperature. [3] The absorption band of cyanmethaegmoglobin in the region of 540 mμ is broad rather than sharp so that its solutions are suitable for use in filter-type photometer as well as in narrow band spectrophotometer.

In Canada, a division of the Department of National Health and Welfare [4], and in the United States, a Subcommittee of the National Academy of Sciences-National Research Council [5], have proposed that in each country the cyanmethaemoglobin method be used to standardize the determination of haemoglobin in all laboratories. This recommendation was made so that haemoglobin values reported throughout each country would be compa-

+ *ICNND became the Nutrition Section, Office of International Research in July,* 1965.
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rable, and to encourage the use of an accurate method that is simple to apply.

METHODS

Two different methods of haemoglobin estimation were used in Mid-Western Nigeria, the Unoghovo and Ibusa surveys.

In Unoghovo, the cyanmethaemoglobin method for the haemoglobin estimation was used. All the necessary reagents and equipment were supplied by the General Hospital in Benin. Drabkin's solution was freshly prepared. Cyanmethaemoglobin was determined by EEL filter-type photomer, using green filter.

Standardization of the method was made by only one standard cyanmethaemoglobin solution (Keller C. Davis) containing 0.049 grams haemoglobin iron per 100ml. which means 251 dilution of blood having haemoglobin content of 12.0 grams per 100 ml. of blood. In addition to the standard solution, one normal adult blood was included as a control (myself). The haemoglobin level of this normal control was 16.4 grams (16.5 and 16.2) per 100 ml. of blood by the EEL photometer in Benin. The blood was taken again from the same person and checked at the Department of Haemotology in University College Hospital, Ibadan by the same method and standard. The result was 16.7 grams (16.9 and 16.6) per 100 ml. of blood.

In the Unoghovo survey, the haemoglobin estimations were performed on 56 cases out of 250 persons mainly under 20 years of age examined clinically.

Blood was taken by finger puncture using a sterile blood lancet. It was thrown away after use.

The first drop of blood was wiped away with a piece of cotton wool and blood drawn by capillary pipette (0.02 ml.). Exactly 0.02ml. blood was pipetted, and after wiping off the outside of the pipette the sample was blown into a universal container which had 5.0 ml of Drabkin solution.

The pipette was rinsed several times and duplicate samples taken [6] The blood samples were collected the last day of the medical examination. They were kept in card box and transported to the Hospital Laboratory and the haemoglobin level measured on the same day.

In Ibusa, 39 blood samples were collected out of 164 persons who went through the medical examination and determined in the field. A drop of undiluted blood was placed on a piece of absorbent paper and compared with a graded scale of colour blocks printed on paper of Tallgovist haemoglobin scale. The haemoglobin levels were reported in terms of percent of the standard.

RESULTS

The results of haemoglobin estimations are shown in Table 1 and 2.

The average haemoglobin level of Unoghovo survey group was 10.7±54 grams per 100ml. of blood (range 7.4-16.7) (see Table 1)

The haemoglobin levels of infants (1-3 years) averaged less than 10 grams per 100 ml. blood and for pre-school (4-6 years) and school children (7-14 years) the respective values were 10.2±1.14 and 10 4±1.19 grams per 100ml, Children over. 15 years of age, (adolescents), have higher haemoglobin levels than the younger children, but less than the figure for adults. The difference in Haemoglbin level between males and females is not marked up to 14 years of age.

In summary, the haemoglobin content of the blood of Unoghovo group was on the whole low.

The average hamoglobin level of the Ibusa community was 82±8.2 per cent (range 45-90) (see Table 2). Children have the lowest haemoglobin levels among the cases studied. Haemoglobin levels of females were in the average, slightly higher than in the males in pre-school and school-going age groups. The average result of the Ibusa survey was below normal range of the Tallqvist Haemoglobin scale (Normal-90-100%)

DISCUSSION

According to Wintrobe [7] the average haemoglobin levels for a normal man should be 16.0 grams per 100 ml. blood (Range 14-18) with a corresopnding haematocrit of 47 per cent (Range 40-50). However, in most surveys the average hae-

moglobin levels of the adult man have been found to be lower. Childien under 14 years of age have hae-moglobin levels below those of men.

Interdepartmental Committee on Nutrition for National Defence [8] has made a worthy attempt to formulate an interpretative guide to haemoglobin data (as well as other biochemical data). Such a guide has been prepared for Nigerian peoples as a result of their survey in Nigeria in 1965 (Table 3).

They have divided the range of haemoglobin levels into the following categories:-

(i) "Deficient"

Less than 10.0 grams per 100 ml. blood

(ii) "Low"

10.0-10.9 grams per 100 ml. blood

(iii) "Acceptable"

11.0-11.9 grams per 100 ml. blood

(iv) "High"

More than 12.0 grams per 100 ml. blood.

The data from the ICNND study of haemoglobin levels in Nigeria classified according to different age groups one shown in Table 4. In order to compare Unoghovo results with ICNND data, groups were re-arranged. There are no important discrepancies between data for haemoglobin in the two surveys. However, according to the ICNND guide, the haemoglobin levels of children in Unoghovo were under "low" category and only few were in "acceptable". Cyanmethaemoglobin method was used both in ICNND and Unoghovo surveys.

The results of Tallqviest method are usually expressed in terms of per cent. The instruction of the Tallqvist Haemoglobin scale which was used in Ibusa survey has shown that the normal range was 90-100 per cent. Varying quantitites of grams of haemoglobin per 100 ml. of blood are given for the 100 per cent of haemoglobin with different scales (vix. 13.8, 16.25 grams per 100 ml. represent 100 %). Therefore, it is difficult to compare the data of Tallqvist method with different methods. There are many reports of haemoglobin estimation in Nageria using Tallqvist method [9] [10] Table 5 shows the comparison of the Ibusa data with those of other reports. Liver and spleen enlargement were found in the persons examined both in Unoghovo and Ibusa survey groups. Hair changes and wasted muscles were also found and percentage incidence of these abnormal clinical findings are given in Table 6.

The dietary survey revealed that the average iron comsumption per caput per day was 12.05 mg. in Unoghovo and 17.68 mg. in Ibusa respectively. Moore [11] has reviewed the available information and concluded the average person absorbs approxi

Table 1: Haemoglnbin Levels in Unoghovo Population Classified According to Age Groups (Cyanmethaemoglobin Method)

Age groups	No. Examined	Hb. (grmm/100ml. blood)		
		Male	Female	Average
under 1 year	1	8.9	—	8.9
1-3 years	11	9.8	10.4	9.9+1.29
4-6 years	12	11.1	9.8	10.+21.14
7-14 years	27	10.6	10.3	410.+1.19
15-19 years	3	10.6	12.4	11.8+1.96
20 years	2	13.3	16.7	15.0

Mean 10.7± 1.54 gram per 100 ml. (Range 7.4-16.7)

Table 2: Haemoglobin Levels in Ibusa. Population Classified According to Age Groups (Tallqvist Method)

Age groups	No. Examined	Haemoglobin (percent)		
		Male	Female	Average
under 1 year	3	80	80	80.0
1-3 years	3	80	80	80.0
4-6 years	6	74	90	76.7
7-14 years	11	73	85	79.5
15-19 years	4	80	85	82.5
20 years	12	89	87	87.5

Means 82±8.2% (Range 45-90)

Table 3: Interpretative guide to Haemoglobin Data for Nigerians 1965 (ICNND)

	Deficient	Low	Acceptable	High
For Children (0-5 years)	Less 10.0	10.0-10.9	11.0-10.9	12.0
For male and female (15yrs)	Less 10.0	10.0-10.9	11.0-11.9	12.0
For pregnant & lactating female	Less 9.0	9.0-9.9	10.0-12.9	13.0

Table 4: Comparison of Haemoglobin Levels of Unoghovo with ICNND Report (Cyanmethaemoglobin Method)

Age groups	Sex	Unoghovo (1966)	ICNND (1965)
0–4 years	Male	9.6	
	Female	10.2	
5–14 years	Male	10.7	11.8
	Female	10.7	11.6
15–24 years	Male	10.8	13.4
	Female	12.4	12.1

Table 5:
Comparision of Haemoglobin Levels of Ibusa with Other Reports (Tallqvist Methods)

Area	Average Haemoglobin levels (%)
Mid-Western Ibusa	82 (90–45)
Burutu (U.A.C.)	77.9 (100–50)
Western Region	
Igun	75.6 (100–50)
Abebeyun	74.3 (110–40)
Eastern Region	
Maku	66.9 (84–45)
Idembia	62.4 (84–45)
Adiasim	58.4 (79–45)
Ediene	66.9 (89–50)

Table 6:
Percentage Incidence of Liver and Spleen Enlargments, and Abnormal Clinical Finding (e.g. hair changes) and Haemoglobin Levels in Unoghovo and Ibusa, Nigeria.

	Unothovo	Ibusa
Number Examined	56	39
Haemoglobin Level	10.7±1.54gm./100ml.	82±8.2%
Liver & Spleen enlargement (%)	9	28
Abnormal clinical Findings (%)	9	10

mately 10% of the dietary iron. To maintain positive iron balance, the amount contained in the food of adult males should be not less than 12–15 mg. per day. The daily requirement, averaged throughout the whole of the first 20 years of life amount-to approximately 10 mg. per day of which appros xim ately 1 mg. per day will be absorbed. Bearing these iron requirements in mind, the dietary surveye indicate that people in Unoghovo and Ibusa have adequate dietary iron content. Explanations for the low haemoglobin levels of these communities may therefore be sought outside dietary iron factors, namely, the widespread dietary protein shortage and the prevalence of parasite diseases. [8),10),12),13)]

SUMMARY

(1) Haemoglobin levels were estimated by cyanmethaemoglobin method in Unoghovo (56 cases) and Tallqvist method in Ibusa 138 cases.

(2) The results presented in Table 1, and 2 indicated that the average haemoglobin levels of these two surveys were low.

(3) Percentage incidence of liver and spleen -en largements were 20% in Ibusa and 9% in Unoghovo (Table 6).

(4) The household survey of average consumption and requirement of these two village, indicated that daily intake of iron per caput was adequate.

(5) The results of these two surveys were compared with other reported studies (Table 4 and 5).

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