PB-225 637

A STUDY OF ANEMIA AMONG RURAL PUNJABI CHILDREN

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Prepared for:

Agency for International Development

4 February 1972

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BIBLIOGRAPHIC DATA SHEET	1. Report No. [redacted] IN-618.92152-U14	2.	3. Recipient's Accession No. PB-225637/8
4. Title and Subtitle: "A STUDY OF ANEMIA AMONG RURAL PUNJABI CHILDREN"			5. Report Date: May 1973
			6.
7. Author(s): Cecile De Sweemer et al			8. Performing Organization Rept. No.
9. Performing Organization Name and Address: John Hopkins University, School of Hygiene & Public Health, Baltimore, Md. 21218			10. Project/Task/Work Unit No. [illegible]
			11. Contract/Grant No. AID/csd-1939
12. Sponsoring Organization Name and Address: Department of State, Agency for International Development, Washington, D.C. 20523			13. Type of Report & Period Covered: Research Bulletin
			14.

15. Supplementary Notes:

16. Abstracts:

In an action-cum-research study among rural Punjabi children under 3 years of age, it was found that anemia has a prevalence of 70%. This indicates anemia in childhood is a public health problem. The age distribution of anemia points to fetal storage and nutritional supply of iron and folic acid as causative factors. Parasitosis seems to play a minor role in the etiology of anemia in this age group. Treatment with oral iron and folic acid was effective but only 36% of the patients were able to collaborate fully with the regimen. A series of preventive measures are outlined which aim at providing proper fetal storage and nutritional supply.

17. Key Words and Document Analysis. 17a. Descriptors:

Reproduced by
NATIONAL TECHNICAL
INFORMATION SERVICE
U.S. Department of Commerce
Springfield VA 22151

17b. Identifiers/Open-Ended Terms:

17c. COSATI Field/Group: 612

18. Availability Statement	19. Security Class (This Report) UNCLASSIFIED	21. No. of Pages 10
	20. Security Class (This Page) UNCLASSIFIED	22. Price $3.00-1.45

Table IV. Mean age at attainment of different puberty signs of girls by per-capita income per-annum

Per-capita income group	Puberty signs				
	Pubic hair	Axillary hair	Breast areola raised	Breast tissue	Menstruation
I (Rs. 50 & less)	13·46	17·52	12·66	12·85	14·02
II (Rs. 51-100)	14·38	14·51	12·61	13·13	14·59
III (Rs. 101-200)	14·44	14·48	12·24	12·75	14·12
IV (Rs. 201-400)	14·12	13·98	11·89	12·39	13·66
V (Rs. 401-600)	13·72	13·45	11·83	12·12	13·32
VI (Rs. 601-900)	13·48	13·20	11·45	11·93	13·31
VII (Rs. 901 & above)	13·31	12·80	11·10	11·56	13·01

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Indian J Med Res 60, 5 May 1972

A Study Of Anemia Among Rural Punjabi Children

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Received for publication February 4 1972

In an action-cum-research study among rural Punjabi children under 3 years of age, it was found that anemia has a prevalence of 70%. This indicates anemia in childhood is a public health problem. The age distribution of anemia points to fetal storage and nutritional supply of iron and folic acid as causative factors. Parasitosis seems to play a minor role in the etiology of anemia in this age group. Treatment with oral iron and folic acid was effective but only 36% of the patients were able to collaborate fully with the regimen. A series of preventive measures are outlined which aim at permitting proper fetal storage and nutritional supply.

Introduction

A study of anemia among rural Punjabi children was undertaken in 11 villages of Ludhiana District, Punjab, by the Rural Health Research Center (RHRC) of the Johns Hopkins University. Challenges in rural health research lie mainly in devising simple but efficient methods of diagnosis and treatment for the most common ailments.

Statistics show that children under 15 years of age constitute 40% or more of the total population in most developing countries, such as India. Low life expectancy in these countries is mainly due to mortality of children under 3 years. This mortality is largely caused by the synergism between malnutrition and infection. Nutritional deficiencies are manifold but protein-calorie malnutrition and iron deficiency anemia are accounting for most malnutrition in these children.

We will limit our discussion here to our own experiences with detection and treatment of anemia in infants and toddlers in the villages of our research studies, and only briefly touch upon the body of literature on the subject. Hemoglobin levels of children are mainly dependent on fetal storage (Fletcher and Suter 1969, Parish and Brame 1954) and postnatal supply of iron, folate, B_{12} and protein (Adams 1969, Chopra and Kevany 1961, Metz, Hart and Harpending 1971, WHO 1968). Furthermore, they are inversely related to intestinal parasite and infectious load (Scrimshaw Taylor and Garden 1968).

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Material and Methods

A high frequency of iron deficient anemia in the children in our study villages could be expected as the prenatal hemoglobin level in the pregnant mothers are extremely low (Table 1) and supplementation of breast milk is delayed until the child can partake in the adult diet. A dietary survey showed that none of the study children received cereal supplements at 6 months of age, 70% of children had some cereal food, mainly chapati, at 12 months of age, 87·5% at 18 months, 96% at 24 months and 100% at 30 months.

Table. 1. Frequency distribution of hemoglobin values of prenatal women in 1967—70 Dhaliwal village Ludhiana District

Hmgb/g%	4—6	6—8	8—10	10—11	11—12	12—13	Total
	2 3·8%	10 18·9%	18 34·0%	12 22·6%	8 15·1%	3 5·6%	53*

*30 out of 53 cases (57%) had less than 10·6%

Measurement of hemoglobin levels and examination of stools was attempted on all children under 3 years of age in 6 villages in view of a campaign approach to treatment of anemia. Thus child population is 638. In all cases home visits were made by the Lady Health Visitor resident in each village. In her first home visit, she explained to each mother the value of measuring her child's hemoglobin and also of examining its stools. In a second home visit the child was called to the clinic in the village or to a convenient, centrally located place of the village where the blood samples were taken. Hemoglobin estimation was done by a trained laboratory technician on the spot. A Sahli hemoglobinometer standardized against a photocolorimeter was used. In the first 30 measurements, which were done with both methods no difference was found bigger than 10% of the highest hemoglobin. The Sahli method was selected because it is easy to handle and is used throughout India in district hospitals and primary health centres. Stools were carried in small plastic containers and preserved by merthiolate. Microscopic examination of stools was done at the headquarters.

Participation of the community in the pre-treatment hemoglobin survey was excellent, 508 or 75% of the children were tested. This was a much higher response than that for stool examinations which was only 264 or 39% of the child population. We feel that the high level of participation in the hemoglobin survey was achieved mainly due to our resident LHV's who won the confidence of the villagers through their on going service. Moreover, a definite promise for treatment for all anemia cases motivated mothers to bring their children for a prick. The survey of stools on the other hand makes greater demands on cooperation and sustained attention both from the mother and the LHV. Because of a cultural taboo the Jats (high caste farmers) showed a greater resistance to handling stools containers. All children with

hookworm, ascariasis, giardiasis or E. histolytica were treated until stools findings became negative.

All children with less than 10 g% of hemoglobin were offered treatment with ferrous sulphate and folic acid tablets. This treatment is cheap, but requires very close follow-up by the LHV and the mother has to be strongly motivated. Out of 418 children needing treatment only 151 were willing for a second measurement of hemoglobin after treatment for at least 2 months (Table IIa). Others may never have taken the treatment or might have exhausted their limit of cooperation when we suggested a repeat measurement. Scheduled caste mothers have a slightly higher cooperation than non-scheduled (Table IIb).

Table IIa. Breakdown of study population

90 cases :	Hmgb over 10 g%
267 cases :	No follow-up measurement
151 cases :	36% of the children needing treatment accepted treatment and follow-up measurement taken

Table IIb. Children accepting treatment by caste

Non-scheduled :	80 treated out of 252 with less than 10 g% (32%)
Scheduled	71 treated out of 166 with less than 10 g% (43%)

Results

Pre-treatment survey : Anemia in children could be expected to have a social gradient. Since hemoglobin levels in prenatal mothers as well as weaning practices, vary in different castes we particularly analysed anemia in our children by caste (Table III). Scheduled caste children have not only a significantly lower median value, but their distribution is also more skewed towards lower values.

Table III. Hemoglobin by caste

Caste/Hmgb g%	4	4·1—7	7·1—10	10·1—12	Over 12	Total
Non-scheduled	1	22	359	57	5	314
Scheduled	1	34	130	26	3	194
Total	2 ·4%	56 11·0%	359 70·7%	83 16·3%	8 1·6%	508

Non-scheduled median = 8·8 g% $\bar{x}$ = 8·8 g%
Scheduled median = 8·5 g% $\bar{x}$ = 8·35 g%
χ^2 = 14·4081 p = ·99

Age distribution of anemia will not only tell us as to what should be the target population in later drives, but it can also give us an indication of the causes of anemia

in infants and toddlers (Table IV). It is striking to note very early anemia in the group under study. Severe forms of anemia were observed in some children of 4 months of age. These cases responded favourably to iron and folic acid. This clearly points to fetal storage as a contributing factor. Moreover the frequency and severity of anemia increases very significantly with age.

Table IV. Evolution of hemoglobin with age

Age in mos. / Hmglb g %	Median	4	4·1—7	7·1—10	10·1—12	Over 12	Total Obs.
0—6	9·2	0	1	65	27	6	99
7—11	8·8	0	2	49	11	0	62
12—23	8·5	1	20	138	22	0	181
24—35	8·4	0	25	93	18	1	137
36*+	8·2	1	8	14	5	1	29
Total	8·6	2	56	359	83	8	508

*36 + on clinical indication only

$\chi^2 = 42{\cdot}195$ $p > {\cdot}999$

The stool survey showed that children under 3 years of age in our villages do not have a parasitic load (Table V). Correlation between parasitic infestations and hemoglobin values is not clear and except in the case of hookworm (Table VI). A comparison of the relationship between giardiasis and hemoglobin values shows that hemoglobin values were not significantly lower as compared to the normal child population of the same villages. But the spread of low and high hemoglobin

Table V. Stools findings by age raw % marked between brackets

Age by months	Normal	Giardiasis	E. Coli	E. Histo.	Hookworm	Ascaris	H. Nana	Others*	Total
0—6	26 (76)	2 (6)	0	0	0	0	0	6 (18)	34
7—11	36 (63)	9 (16)	1 (2)	0	0	0	0	11 (19)	57
12—23	51 (59)	17 (20)	4 (5)	0		1 (1)	2 (2)	11 (13)	86
24—35	24 (33)	21 (29)	8 (11)	1 (1)	1 (1)	1 (1)	3 (4)	14 (19)	73
36+	5 (21)	3 (21)	3 (21)	0	2 (14)	0	1 (7)	2 (14)	14
Total	140 (53)	52 (20)	16 (6)	1 (0)	3 (1)	2 (1)	6 (2)	44 (17)	264

*Erythrocytes and leucocytes

values as indicated by standard deviations shows significantly more polarization in cases with giardia than in the normal population. This suggests that quantitative parasitic load or some other resistance characteristics may play a role in influencing hemoglobin values. The clarification of the role of giardiasis will require further research.

Table VI. Correlation between stool findings and hemoglobin

Hmgb g%	Stools parasites	Normal	Giardiasis	Hookworm	RBC	Others*	Total
4		7	0	1	1	1	10
4·1—7		10	6	1	6	5	28
7·1—10		104	35	1	30	15	155
10·1—12		18	9	0	7	3	37
12+		1	2	0	0	1	4
Total		140 53·0%	52 19·7%	3 1·1%	44 16·7%	25 9·5%	264
Median		8·5 g%	8·7 g%	5·5 g%	8·5 g%	8·3 g%	8·5 g%
$\bar{x}$ =		8·394 g%	8·73 g%				
σ^* =		2·8 g%	4·88 g%				

*E. Coli, Ascaris, H. Nana, E. Histolytica

Post-treatment survey: The second set of measurements show a very significant shift to higher values though 16 cases were still found to be 7 g% or lower (Table VII). As we felt that these cases would not respond to oral treatment they were continued on i.m. iron. The improvement achieved with oral iron and folic acid therapy clearly suggests that nutritional factors contribute to this type of chronic anemia.

Table VI. Effect of treatment with oral iron and acid after 2 months treatment

Status	Hmgb g%	<4	4·1—7	7·1—10	10·1—12
Before treatment		1 ·7%	31 20·5%	119 78·8%	0
After treatment		1 ·7%	13 8·6%	111 73·5%	26 17·2%

χ^2 = 33·6419, p = ·999

Discussion

The experience has taught us anemia in children under 3 years is a public health problem in the Punjabi villages. Fetal storage and nutritional supply of iron and folic acid seemed to be the major responsible factors. A campaign approach supplying oral iron and folic acid did though only effectively reach 36% of the target population. Obviously our logistics need further refinement but we think anemia in children can be successfully treated in a rural setting with simple means. We would

like to shift the emphasis from curative to a preventive approach and we have already adopted the following preventive policy in our villages.

1. The major effort on the prevention of iron deficiency anemia in infants and young children will be attempted by building the iron store in the developing foetus by liberal use of iron during the antenatal period and also by widening the spacing of pregnancies.

2. Infants identified as likely to develop iron deficiency anemia such as a prematures, or children with low birth weights or infants born of anemic mothers will require more intensive preventive measures, and oral iron and folic acid will be given to them from 2nd to 3rd months onwards. The iron will be administered as ferrous ammonium citrate mixture as this is more convenient.

3. As infant feeding practices are culturally determined, detailed information about them are obtained before introducing the new feeding practices. Even in the same community the feeding practices show variation from one caste to another. Feeding patterns, along with many other elements of culture, are largely determined for any particular people, by tradition.

4. Educational efforts will be undertaken to reach all levels of professional and auxiliary health workers and Gram Sevikas who counsel parents regarding feeding practices.

5. Mother will be advised that semi-solid cereal preparations should be introduced as early as 4-6 months of age. Green vegetables, (peas, beans, spinach etc.) should be given at least from 10 months onwards. As an educational device, semi-solid cereals offered daily in each village in a central kitchen. Mothers are encouraged to send or bring their children.

6. So as to evaluate our programme, baseline data about the prevalence of anemia will be collected in each village before educational or other activities are initiated. Data on concentration of hemoglobin of infants and small children should cover at least 75-80% of the total child population including both healthy and sick children, in all age groups. Subsequent determination of hemoglobin levels will permit us to judge the effectiveness of the programme.

Acknowledgment

This research was supported by NIH grant AM11047 and WHO grant N3/181/5 (B). We would like to thank Sr. N. Masih for her help in organizing the survey and Mr. F. Masih for the actual hemoglobin estimation and stool examinations.

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