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Age and ethnic variation of Haemoglobin levels in 14 Endogamous groups of Rajasthan, Punjab and Himachal Pradesh, India

The distribution of Haemoglobin level (Hb gm %) on the basis of 1114 individuals belonging to 14 endogamous groups of Rajasthan, Punjab and Himachal Pradesh is studied here. The purpose of the study is to assess: (1) the normal range; (2) effect of age in normal range; (3) effect of geographical influence on the normal level; and (4) any ethnic variation regarding normal range.

The population groups are: Paliwal Brahmin; Rajput; Oswal Mahajan; Meghwal; Bhil; Meena (Rajasthan); Jat Sikh; Mahajan Agarwal; Ramdashia Sikh (Punjab); Brahmin; Chowdhuri; Chamar; Gaddi Rajput; and Nepali (Himachal Pradesh).

The Hb level ranges between 10.65 gm% (Nepali) and 16.0 gm% (Oswal Mahajan) in the total sample. There are significant variations between populations for ages 11, 12, 13, 14, 17, 18, 19 and 20. Significant variations also exist over ages in Meena, Rajput, Paliwal Brahmin, Ramdashia Sikh, Jat Sikh and Gaddi Rajput. An attempt has been made to compare the present findings with other Indian as well as world populations.

Key words: Haemoglobin level, endogamous groups, India.

Introduction

There is a growing anthropological interest in the ethno-geographical diversities of haemoglobin level in human populations. Haemoglobin is a very important constituent of blood, the main function of which is to carry oxygen. The concentration of haemoglobin in blood is influenced by a number of factors such as nutritional status, age, sex, climate, altitude, in addition to immune response etc., and the normal haemoglobin ranges are determined accordingly. The information about the distribution of Hb level in the normal populations belonging to different ethnic groups are scanty, particularly in India (BHALLA, 1958; BEALL & BIECHSMAN, 1984; GUPTA *et al.*, 1983; DAS & MUKHERJEE, 1978; BHASKAR *et al.*, 1975; NAPIER & DAS GUPTA, 1940; RAO *et al.*, 1954; RAMALINGASWAMI & VENKATCHALAM, 1950). It is interesting to study the variation of Hb level in various Indian populations from different places. An attempt has been made here to study the Hb level (gm%) in 14 endogamous populations from 3 north-western States of India to evaluate: (i) the normal range of Hb level in the males of age between 10-20 years; (ii) the effect of age on the normal range; (iii) the effect of geographical influence on the normal level; and (iv) any ethnic variation regarding the distribution of normal range. The present paper is a part of an Indo-Soviet collaborative project conducted in north-western India in 1979 where 14 population groups were extensively studied for anthropometry, dermatoglyphics, odontology, body constitution, biochemical markers in blood and other genetic variables.

Material and Methods

A total of 1,114 individuals belonging to a 10-20 year old age group from 14 endogamous populations were screened for Hb gm % level as follows. *Rajasthan:* (1) Paliwal

Brahmin, a high caste group, mostly with white collar jobs; (2) Rajput, a dominating middle caste group having agriculture as their main occupation; (3) Oswal Mahajan, a middle caste group, mostly engaged in trade and business; (4) Meghisal, a schedule caste group, having agriculture as their main occupation; (5) Bhil and (6) Meena, both belong to tribes and live on forest resources and manual labour. *Punjab*: (7) Jat Sikh, corresponds to the Rajputs of Rajasthan, a dominating group, mostly agriculturist; (8) Mahajan Agarwal, a trader caste group comparable with the Oswal Mahajan of Rajasthan; (9) Ramdashia Sikh, belong to low rank in the social hierarchy, followers of Guru Ramdass and mostly agriculture labourers. *Himachal Pradesh*: (10) Brahmin, high caste group, mostly with white collar job; (11) Chowdhuri, middle caste, agriculturists; (12) Chamar, a low caste group, most are daily wage earners and some are engaged in traditional tanning business; (13) Gaddi Rajput, a tribe, depends on forest resource as well as agriculture; (14) Nepali, Nepali speaking, mixed group, originally inhabitants of different parts of Nepal, in the Himalayas, mostly engaged in small business and services.

The individuals were sampled from the villages within 20 km in Udaipur in Rajasthan, in and around Patiala in the Punjab and Dharamshala of Himichal Pradesh. All these places are approximately within mean sea level, 400 feet to 3800 feet. The estimation of Hb gm% was done in the field itself, from the finger tips of the subjects by 'Sahli' haemoglobinometer, following the oxy-haemoglobin method. Blood samples were tested from the males belonging in the age groups 10-20 years, who volunteered to be examined for various anthropometric measurements and other tests. Thus the number of individuals belonging to a particular age group was random.

Results and Discussion

Table 1 gives the age, specific estimated Hb gm percentage norms (mean), along with the s.e. of the estimated mean for different endogamous groups in three locations. The number of individuals on which these estimates were made is given within parentheses. It may be seen from *Table 1* that all frequencies are low for the ages 10, 11, 19 and 20 for most of the population groups. The estimated age specific Hb gm % presented, are to be used with caution whenever the sample sizes are small. The minimum (10.65) and maximum (16.0) Hb gm % have been noticed in the Nepali of Dharmashala and Oswal Mahajan of Rajasthan respectively.

Table 2 is presented to study the variability in Hb gm percentage between ages and ethnic groups. The means are arranged for different ages, in decreasing order, with the corresponding population number within parentheses. Thus, for example, 13 year old Chowdhuries from Dharmashala are very similar to 13 years old Jat Sikhs of Punjab in comparison to most other populations, whereas, these two ethnic groups are most divergent for 17 years old. However, for statistical comparison of Hb gm % for various populations and ages, appropriate procedures, like analysis of variance have not been attempted here, because such analysis with random frequencies within cells may overshadow the very purpose of the study. Only the following tests of significance were done, depending on the sample sizes: (1) for each age, the range of variation in Hb gm% (based on mean Hb gm%) in the different populations; (2) within each population, the range of variation in the Hb gm% (based on mean Hb gm%).

Table 3 and 4 give the results of mean Hb gm; variations ('t'-test) in populations within the same age group; and variations ('t'-test) between ages in the same population respectively.

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TABLE 2 - Mean Hb gm. percentage in decreasing order in the age groups and corresponding population.

Age (yrs)	Population No. within parenthesis													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
10	12.67 (14)	12.2 (7)												
11	13.25 (2)	12.80 (8)	12.76 (7)	12.50 (5)	12.50 (11)	12.45 (3)	11.40 (9)	11.00 (6)	10.65 (10)					
12	13.37 (5)	13.36 (4)	12.66 (10)	12.60 (14)	12.33 (9)	12.30 (1)	12.29 (7)	12.20 (11)	12.14 (8)	12.09 (12)	11.89 (6)	11.44 (3)	11.00 (2)	
13	13.18 (11)	13.16 (4)	12.70 (10)	12.50 (13)	12.49 (6)	12.47 (9)	12.46 (5)	12.40 (12)	12.21 (8)	12.07 (3)	12.06 (14)	12.05 (7)	12.02 (1)	11.87 (2)
14	12.97 (4)	12.77 (11)	12.76 (8)	12.76 (13)	12.60 (5)	12.58 (6)	12.49 (10)	12.40 (12)	12.39 (14)	12.26 (9)	12.18 (1)	12.10 (7)	11.83 (2)	11.81 (3)
15	13.10 (11)	13.04 (6)	13.02 (5)	12.97 (8)	12.92 (10)	12.90 (9)	12.90 (4)	12.84 (14)	12.83 (7)	12.62 (2)	12.51 (12)	12.44 (1)	12.13 (3)	12.13 (13)
16	14.14 (9)	13.72 (11)	13.62 (4)	13.54 (8)	13.24 (5)	13.21 (14)	13.20 (10)	13.15 (6)	13.05 (7)	12.78 (2)	12.73 (12)	12.64 (13)	12.63 (1)	12.58 (3)
17	15.50 (9)	14.09 (12)	13.84 (4)	13.72 (10)	13.53 (11)	13.45 (14)	13.44 (1)	13.33 (7)	13.24 (2)	13.00 (8)	13.00 (5)	12.84 (3)	12.65 (6)	12.50 (13)
18	15.30 (5)	15.02 (14)	14.75 (12)	13.43 (11)	14.00 (9)	13.86 (7)	13.33 (10)	13.23 (13)	13.13 (2)	13.15 (4)	12.95 (6)	12.94 (3)	12.90 (1)	12.00 (8)
19	16.0 (4)	15.50 (5)	15.08 (14)	14.50 (12)	14.30 (7)	14.25 (10)	13.58 (1)	13.50 (2)	13.10 (6)	13.00 (8)	12.35 (13)			
20	15.58 (14)	15.50 (9)	14.95 (8)	14.15 (13)	14.00 (6)	13.75 (14)	12.95 (13)	12.50 (10)	12.00 (6)	11.50 (11)				

TABLE 3 - Mean Haemoglobin gm. percentage variations in populations within the same age.

Age in years	Mean Hb. gm. %		t value
	Maximum	Minimum	
10	12.67	12.20	0.71
11	13.25	10.65	3.25 *
12	13.37	11.00	2.77 *
13	13.18	11.87	2.44 *
14	12.97	11.81	3.25 *
15	13.10	12.13	1.18
16	14.14	12.58	1.99
17	14.09	12.50	4.01 *
18	15.30	12.00	4.71 *
19	15.08	12.35	3.51 *
20	15.58	11.50	5.00 *

TABLE 4 - Mean Haemoglobin gm. percentage variations between ages in the same population.

Populations	Mean Hb. gm. %		t value
	Maximum	Minimum	
1	13.58	11.50	4.61 *
2	14.00	11.00	1.40
3	13.25	11.44	1.62
4	13.84	12.90	1.69
5	15.30	12.46	2.18 *
6	13.15	11.89	2.16 *
7	14.30	12.05	6.44 *
8	14.95	12.00	2.77
9	14.14	11.40	3.52 *
10	14.25	10.65	2.11
11	14.43	12.77	1.99
12	14.75	12.09	3.94 *
13	13.23	12.13	1.38
14	15.58	12.06	5.40

It has been observed that there are significant variations between populations for ages, 11, 12, 13, 14, 17, 18, 19 and 20 but not in ages 10, 15 and 16 (Table 3). There is also a significant variation in Hb gm% over ages in Meena, Rajput, Paliwal Brahmin (all in Rajasthan), Ramdashia, Jat Sikh (both in Punjab), and Gaddi Rajput (in Dharmashala), and the rest of the populations show no significant differences according to age (Table 4).

An attempt was also made to compare the Hb gm% norms of these populations for various ages, with other Indian populations as well as with the rest of the world. But the age-specific norms of Hb gm% available in literature are scanty, and particularly, very few data are available for Indians. BHALLA (1958) had reported age-specific (10 years to 20 years) Hb gm% for two ethnic communities residing at an altitude of about 9500 feet above sea level. Since the populations investigated in this study are located at a comparatively much lower altitude, no attempt has been made to compare the age-specific Hb gm% figures of this study with Bhalla's findings.

DEVIATION ACCORDING TO AGE IN Hb.gm% FROM BRITISH NORMS FOR 14 INDIAN POPULATIONS

(Numbers against dots are population numbers)

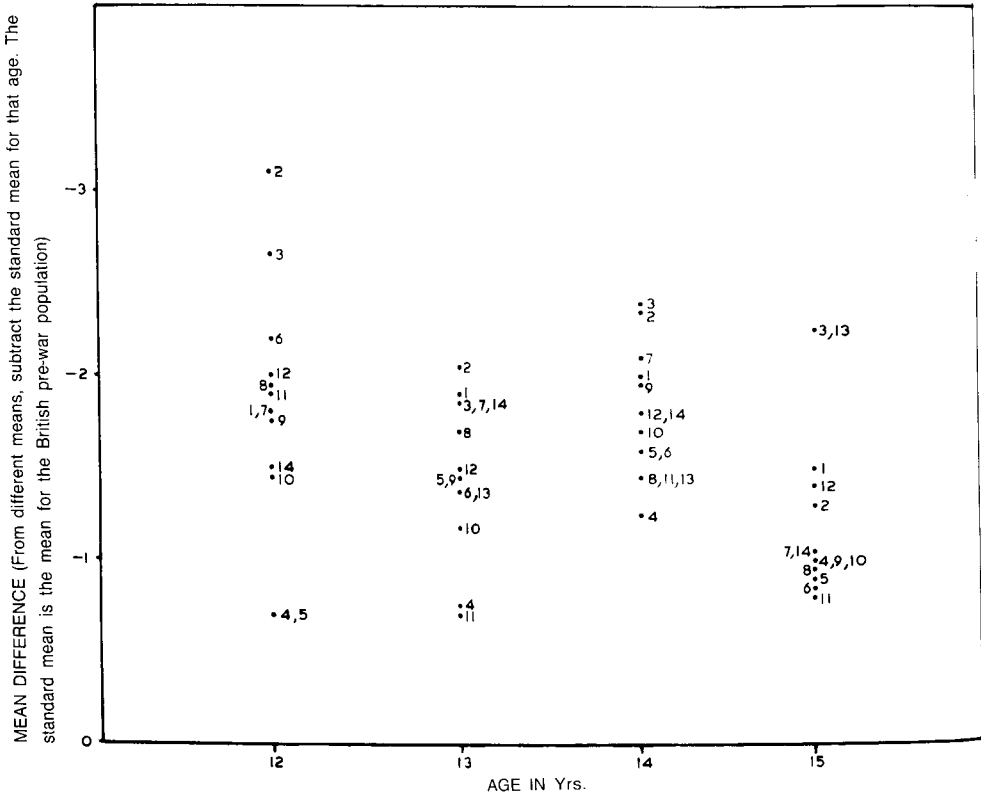


Fig. 1.

The norms of Hb gm% for the ages 12 (14.1 gm%), 13 (13.9 gm%), 14 (14.2 gm%) and 15 (13.9 gm), are available for the children in pre-war Britain (1955). The comparisons are made only for these four ages and presented in Figure 1. It may be noted that all norms obtained in this study are lower than that of the pre-war British standard, with up to 3 gm% deviation for 12 years olds, over 2 gm% for 13 years olds, about 2.5 gm% for 14 years olds, and for 15 years olds it is close to 3 gm%.

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