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Research Article

TO STUDY THE PREVALENCE AND RISK FACTORS OF *PANDU ROGA* VIS-À-VIS ANAEMIA AMONG SCHOOL GOING CHILDREN

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ABSTRACT

Anemia is very common problem among rural as well as urban areas of the country. The prevalence of anaemia in general and iron deficiency anaemia in particular is presently rising in the society. The primary objective of this study was to determine the prevalence of anaemia among school going children in rural and semi urban areas of Kangra district (Himachal Pradesh). Secondary objective was to identify the etiological and contributory factors in anaemia on the basis of Ayurvedic fundamentals. **Methods:** A population of 200 children studying in different schools of rural and semi urban areas of Kangra district Himachal Pradesh and IPD as well as OPD of department of Kaumarbhritya, R.G.G. P.G. Ayurvedic College and hospital Paprola were included in the survey. The data obtained from the survey was evaluated to assess the prevalence of anemia and its correlates. To fulfill the aims and objectives a specially prepared performa was designed and all details of the children were recorded in it. **Results:** The prevalence of anaemia was found to be 69% in school going children in rural areas of *Kangra* district, Himachal Pradesh. The major risk factors which were observed in present study were nutrition, socio-economic status, pica and dewormification. **Conclusion:** Anaemia is comparatively more common among children of semi urban and rural areas of Himachal Pradesh possible due to multiple factors like low socioeconomic status, menstruation and inadequate diet etc.

KEYWORDS: *Pandu roga,* Prevalence of anaemia, Aetiological and risk factors.

INTRODUCTION

Iron deficiency anemia is a condition in which there is depletion of iron stores of body, where iron stores exceed iron intake for a long time and insufficient iron is available for normal hemoglobin production. *Pandu* is like the color of pollen grains of *Ketaki-* flower, which is whitish yellow. Iron deficiency Anaemia can clinically manifest with various features like pallor, anorexia, irritability and pica etc. The features are almost similar with that of *Pandu roga* mentioned in Ayurvedic classics. A child is said to be patient of anaemia having Hb<11gm/dl (6 months- 6 years) or Hb<12gm/dl (> 6 years age). Anaemia can be classified on the base of blood loss, hemolytic and impaired RBC production. The indigenous system of medicine in India has described *Pandu* (disease of pallor) which includes various types of anaemia. The prevalence of anaemia in general and iron deficiency anaemia in particular is presently rising in the society. The urban as well as rural population of Himachal Pradesh is also becoming victim of this particular disease. Presently there is no authentic data of prevalence of iron deficiency in rural and semi-urban areas of Himachal Pradesh. Hence, the survey study was planned to assess the prevalence of anaemia and its correlates in rural and semi-urban areas of Himachal Pradesh.

AIMS AND OBJECTIVES

To study the prevalence and risk factors of *Pandu roga* vis-à-vis Anaemia among school going children.

MATERIAL AND METHODS

Criteria of selection study subjects

All the study subjects were selected instead of having any prior information of diseased of wellness. Study subjects i.e. 200 children studying in different schools of rural and semi urban areas of Kangra district Himachal Pradesh and IPD as well as OPD of department of *Kaumarbhritya*, R.G.G. P.G. Ayurvedic College and hospital Paprola were included in the survey.

Subjective and objective parameters

Age, sex, religion, socioeconomic status, type of delivery, birth weight, history of breast feeding,

recurrent infection and dewormification, diet, bowel habit, menstrual history, sleep, palpitation, pica, history of participation in any national program related to anaemia were included under subjective parameters while heamoglobin value was only objective parameters for survey study.

A questionnaire related to probable risk factors of anaemia had been filled up as per answered by children/parents i.e. yes or no etc. Parents or children were asked/ observed regarding the presence or absence of objectives like weakness, appetite, irritability, repeated spitting, and demographic details. Haemoglobin estimation was carried out by manual method. On the basis of heamoglobin values i.e. Hb<11gm/dl (6 months-6 years age) or Hb<12gm/dl (> 6 years age), study subjects were confirmed as anemic or non-anaemic. Informed consent was taken from the parents/ guardians of the children prior to the survey study after offering sufficient explanations about the study and its aims.

The data obtained from the survey was evaluated to assess the prevalence of anemia and its correlates i.e. etiological and contributory factors in the disease iron deficiency anaemia on the basis of Ayurvedic fundamentals to fulfill the aims and objectives.

OBSERVATIONS AND RESULTS

Out of 200 survey study subjects, 138 children were observed anaemic in their age specific respective groups Observation Table (1)

Table 1: Study subjects

S.No.	Name of Parameters		Numbers of children N=200	Percentage	Haemoglobin value (gm/dl)
1	Age	6-12 yrs	92	46%	10.26
		12-18 yrs	108	54%	10.02
2	Sex	Male	114	57%	11.31
		Female	86	43%	11.26
3	Religion	Hindu	199	99.5%	11.28
		Other	1	0.5%	11.27
4	SES	Upper	4	2%	12.2
		Middle	164	82%	11.35
		Lower	32	16%	10.94
5	Type of Delivery	NSVD	162	81%	11.24
		LSCS	38	19%	11.51
6	Birth Weight	≤ 2.5 kg	61	30.5%	10.80
		> 2.5 kg	129	69.5%	11.51
7	Ex.Breast Feeding	Present	173	86.5%	11.34
		Not present	27	13.5%	10.95
8	H/O Recurrent Infection	Present	42	30.43%	10.61
		Absent	96	69.56%	10.77
9	School performance	Good	59	29.5%	11.53
		Average	114	57%	11.28
		Low	12	6%	10.05
10	H/O Dewormification	Yes	170	85%	11.32
		No	30	15%	11.11
11	Appetite	Increased	46	23 %	11.65
		Normal	31	15.5%	10.43
		poor	123	61.5 %	11.37
12	Diet	Vegetarian	54	27%	10.97
		Mixed	146	73%	11.41
13	Bowel Habit	Regular	195	97.5%	11.63
		Irregular	5	2.5%	9.88

14	Menstrual status	Menstruating	21	24.41%	10.30
		Non –menstruating	65	75.59%	11.52
15	Menstrual Blood Loss*	Normal/less	17	81%	10.28
		Excess	4	19%	9.8
16	Sleep	Disturbed	27	13.5%	11.06
		Normal	173	86.5%	11.40
17	Palpitation	Not Present	154	77%	11.56
		On doing routine physical activity	30	15%	9.6
		On doing strenuous physical activity	16	8%	10.36
18	H/O Pica	Not Present	154	77%	11.56
		Present	44	23%	10.43
19	H/O Spitting	Present	19	9.5%	9.84
		Not present	181	90.5%	11.44
20	Calf Muscle Pain	Present	27	13.5%	10.20
		Absent	173	86.5%	11.96
21	H/O participation in national programme	Present	79	39.5%	11.48
		Not present	121	60.5%	11.17

Observations of Total Study Subjects (n-200)

In this study, maximum children 108 (54%) were from age group of 12-18 years. 92 (46%) were from age group of 6–12 years. According to age group wise haemoglobin distribution, 138 children (69%) were found to be anaemic. In the present study, 114 (57%) children were males and 86 (43%) children were females. Mean haemoglobin suggest that females (11.26gm) were having less haemoglobin than males (11.31gm). Only a single volunteer in the present study was Non-Hindu where as 199 (99.5%) study subjects were Hindu.

In this survey, maximum children 164 (82%) were from middle socio-economic families while 32 (16%) were from lower socio-economic families. 4 (2%) children were from upper socio economic families. Least mean haemoglobin value is seen in children of lower socio-economic status. In present survey, 162 (81%) children had history of normal vaginal delivery while 39 children (19%) were delivered by lower segment caesarian section. In 61 (30.5%) patients the birth weight was found ≤ 2.5kg. More than 2.5kg birth weight was observed in 129 (69.5%). The mean haemoglobin value was greater in children who were born with more than 2.5kg birth weight. 173 (86.5%) children were having history of exclusive breast feeding till 6 months of age while in 27 (13.5%) children were having history of less than 6 months of breast feeding was present.

Study subjects were questioned about first stepping time to inquire mile stones achievement status. It was observed that early stepping and moderate stepping time was present in 97-97 study subjects with mean haemoglobin 11.6gm/dl and 11.04gm/dl respectively while delayed stepping was noticed in 6 (3%) children and their mean haemoglobin value was 9.7gm/dl. 114 (57%) children in the present survey study were having average school performance and their mean haemoglobin was 11.28 gm/dl, while 59 (29.5%) had very good school performance. Only 12 (6%) children in the study had poor school performance. History of recurrent infection was present in 50 (25%) study subjects and their mean haemoglobin was 10.56gm/dl whereas 150 (75%) study subjects had no history of recurrent infection and their mean haemoglobin was 11.53gm/dl. 170 (85%) children had history of dewormification during last six months whereas 30 (15%) had no history of dewormification in last six months. 123 (61.5%) children had poor appetite, 46 (23%) had increased appetite while only (46) 23% were having normal appetite. Most of the children 146 (73%) were enjoying mixed diet and their mean haemoglobin value was 11.41gm/dl while rest of the children 54 (27%) were vegetarians with mean haemoglobin value 10.97gm/dl. Maximum children 195 (97.5%) had regular bowel habit with mean haemoglobin 11.63gm/dl whereas 5 (2.5%) children had irregular bowel habit and their mean haemoglobin level was 9.88gm/dl.

Analysis of survey data indicates that 86 female were present in this study out of them 21

female children (24.41%) had attained menarche and their mean haemoglobin value was 10.30 gm/dl. 65 female children (75.59%) in the present study had not attained menarche and their mean haemoglobin levels were 11.40gm/dl. Among 21 females, 17 (81%) had normal or less than normal blood loss during menstruation and their mean haemoglobin value was 10.28gm/dl while excess bleeding was noticed in only 4 (19%) females and their mean haemoglobin value was 9.8 gm/dl.

In the survey, sound sleep was present in 173 (86.5%) children were enjoying sound asleep while 27 (13.5%) were having disturbed sleep. 154 (77%) gave the history of no palpitation and their mean haemoglobin was 11.56 gm/dl. 30 children (15%) had palpitation on doing routine physical activity. Their mean haemoglobin value was 9.60gm/dl. Only 16 (8%) gave history of palpitation on doing strenuous physical activity and their haemoglobin was 10.43gm/dl. 154 (77%) did not gave the history of pica and their mean haemoglobin was 11.56 gm/dl. 44 children (23%) had history of pica and their mean haemoglobin value was 10.43gm/dl. Repeated spitting habit was observed in only 19 (9.5%) of total 200 children. Their mean haemoglobin value was 9.84gm/dl. 181 children (90.5%) had no repeated spitting habit and their mean haemoglobin value was 11.44gm/dl. 173 children (86.5%) had no complaint of calf muscle pain with mean haemoglobin value 11.96gm/dl. On the other hand only 27 (13.5%) had with complaint of calf muscle pain and mean haemoglobin value 10.20gm/dl. 121 (60.5%) children had no history of participation in any iron program related to anemia while 79 (39.5%) had history of participation in such program. The mean haemoglobin value was 11.48gm/dl and 11.17gm/dl in both groups respectively.

Observations of Anaemic Study Subjects (n-138)

Table 2: **Observation**

S.No.	Name of Parameters		Numbers of children N=138	Percentage	Haemoglobin value (gm/dl)
1	Age	6-12 yrs	59	42.76%	10.26
		12-18 yrs	79	57.24%	10.02
2	Sex	Male	76	56.28%	10.60
		Female	62	44.92%	10.57
3	Religion	Hindu	137	99.27%	11.38
		Other	1	0.73%	11.24
4	SES	Upper	2	1.48%	10.38
		Middle	108	78.26%	10.66
		Lower	28	20.28%	9.5
5	Type of Delivery	NSVD	114	82.60%	10.60
		LSCS	24	17.39%	10.50
6	Birth Weight	≤ 2.5 kg	52	37.69%	10.39
		> 2.5 kg	86	62.31%	10.70
7	Ex.Breast Feeding	Present	111	80.43%	10.68
		Not present	27	19.56%	10.19
8	H/O Recurrent Infection	Present	42	30.43%	10.61
		Absent	96	69.56%	10.77
9	School performance	Good	39	28.28%	10.78
		Average	77	55.79%	10.58
		Low	12	8.69%	10.05
10	H/O Dewormification	Yes	113	81.81%	10.61
		No	25	18.19%	10.19
11	Appetite	Increased	13	9.42%	10.93
		Normal	28	20.28%	10.67
		poor	97	70.28%	10.13
12	Diet	Vegetarian	43	31.15%	10.30
		Mixed	95	68.84%	10.71

13	Bowel Habit	Regular	131	94.92%	10.59
		Irregular	7	5.07%	10.50
14	Menstrual Status	Menstruating	9	16.98%	10.04
		Non –menstruating	44	83.01%	10.86
15	Menstrual Blood Loss*	Normal/less	5	55.56%	10.11
		Excess	4	44.44%	9.6
16	Sleep	Disturbed	22	15.95%	9.88
		Normal	116	84.05%	10.67
17	Palpitation	Not Present	98	71.01%	10.75
		On doing routine physical activity	12	8.69%	10.51
		On doing strenuous physical activity	28	20%	9.08
18	H/O Pica	Not Present	106	76.81%	10.68
		Present	32	23.19%	10.20
19	H/O Spitting	Present	19	13.76%	9.84
		Not present	119	86.23%	10.78
20	Calf Muscle Pain	Present	116	79.71%	10.71
		Absent	27	19.56%	10.08
21	H/O participation in national programme	Present	48	34.78%	10.96
		Not present	90	65.21%	10.53

In this study, maximum anaemic children 79 (57.24%) were in the age group of 12-18 years followed by 59(42.76%) in the age group of 6–12 years. 76 (56.28%) patients were males and 62 (44.92%) patients were females. Mean haemoglobin value (10.57gm/dl) in female children whereas male had higher haemoglobin value (10.60gm /dl) than females as per WHO criteria. In this survey, maximum patients 108 (78.2%) were from middle class family while 28 children (20.28%) were from lower socio-economic families. 2 (1.4%) patients were from upper socio-economic class. Least mean haemoglobin value is seen in children of lower socio-economic status. 114 (82.60%) children were delivered by normal vaginal delivery while 24 (17.39%) by lower segment caesarean section delivery. In 52 (37.69%) patients the birth weight was found ≤ 2.5kg. More than 2.5kg birth weight was observed in 86(62.3%). The mean haemoglobin value was greater in children who were born with more than 2.5kg birth weight. 111 (80.4%) patients were having history of exclusive breast feeding till 6 months of age while in 27 (19.5%) patients a history of less than 6 months of breast feeding was present. Study subjects were questioned about first stepping time to inquire mile stones achievement status. It was observed that early stepping and moderate stepping time was present in 57 (41.30%) and 75 (54.34%) study subjects with mean haemoglobin 10.93gm/dl and 10.40gm/dl respectively while delayed stepping time was noticed in 6 children (4.34%) and their mean haemoglobin value was 9.76gm/dl.

Most of the children i.e. 77 (55.79%) in the present survey study were having average school performance and their mean haemoglobin was 10.58gm/dl, while 39 (28.28%) had very good school performance. Only 12 (8.69%) children in the study had poor school performance and their mean haemoglobin value was 10.05gm/dl. With the mean haemoglobin value 10.77gm/dl, 96 (69.56%) children were having no history of recurrent infection while rest children i.e. 42 (30.43%) were having a history of recurrent infection and their mean haemoglobin value was 10.61(gm/dl). 113 (81.81%) children had history of dewormification during last 6 months where as 25 (18.19%) had no history of dewormification in last 6 months back. 97 (70.28%) patients had poor appetite, 13 (9.4%) had increased appetite while only 28 (20.28%) were having normal appetite. Most of the children 95 (68.84%) were enjoying mixed diet and their mean haemoglobin value was 10.71gm/dl while rest of the children 43 (31.15%) were vegetarians with mean haemoglobin value 10.30gm%.

Maximum children 131 (94.92%) had regular bowel habit with mean haemoglobin 10.59gm/dl whereas 5 (5.07%) children had irregular bowel habit and their mean haemoglobin level was 10.50gm/dl. Analysis of survey data indicates that 53 female were present in this study out of them 9 female children (16.98%) had attained menarche and

their mean haemoglobin value was 10.04 gm/dl. 44 female children (83.01%) in the present study had not attained menarche and their mean haemoglobin levels were 10.86gm/dl. Among 9 female children, 5 (55.56%) females had normal or less than normal blood loss during menstruation and their mean haemoglobin value was 10.11gm/dl while excess bleeding was noticed in only 4 (44.44%) females and their mean haemoglobin value was 9.6gm/dl.116 (84.05%) patients were enjoying sound asleep while 22 (15.95 %) were having disturbed sleep.

In present survey study, 98 (71.01%) gave the history of no palpitation and their mean haemoglobin was 10.75gm/dl. 28 children (20.28%) had palpitation on doing routine physical activity. Their mean haemoglobin value was 9.08gm/dl. Only 12 (8.69%) gave history of palpitation on doing strenuous physical activity and their haemoglobin was 10.51gm/dl 106 (76.81%) did not gave the history of pica and their mean haemoglobin was 10.68gm/dl. 32 children (23.19%) had history of pica and their mean haemoglobin value was10.20gm/dl. Repeated spitting habit was observed in only 19 (13.76%) of total 138 children. Their mean haemoglobin value was 9.84gm/dl. Rest of the children 119 (86.23%) had no history of repeated spitting and their mean haemoglobin value was 10.78gm/dl. In the survey of 200 children, maximum patients 116 (79.71%) had no complaint of calf muscle pain and their mean haemoglobin value was 10.71gm/dl. One the other hand only 27 (19.5%) had complaint of calf muscle pain and mean haemoglobin value 10.08gm/dl.90 (65.21%) children had no history of participation in any iron program related to anemia while 48 (34.78%) subjects had history of participation in such program. The mean haemoglobin value was 10.53gm/dl and 10.96gm/dl in both groups respectively.

The common clinical features observed in anaemic children (138) in present study were pallor skin and conjunctiva (100%), poor appetite (79.7%), shortness of breath (28.99%), pica (23.19%), calf muscle pain (19.56%), disturbed sleep (14.94%), repeated spitting (13.76%), poor school performance (8.69%), irregular bowel habit (5.07%) and delayed mile stones (4.34%).

DISCUSSION

In present study we tried to see the prevalence of anaemia in rural and semi urban areas of district *Kangra* as well as to study its causative factors in the area. The major outcomes from the survey are as discussed below.

Table 3: Prevalence of Anaemia

Age group	No of children	Anaemic children (Hb≤12gm/dl)	Non-anaemic children (Hb>12gm/dl)
6-12 years	92	59 (64.13%)	33 (35.87%)
12-18 years	108	79 (73.14%)	29 (26.86%)
Total	200	138 (69%)	62 (31%)

The prevalence of anaemia was found to be 69% in school going children in rural areas of Kangra district, Himachal Pradesh. NFHS 2015-16 suggests that prevalence of anaemia in Himachal Pradesh is 53.57% in urban area but higher in rural children. Prevalence of anaemia globally[1] is 46% and in India it is 59%[2]. In developing states of India like Bihar, prevalence of anaemia is found as high as 66%. Another study revealed that 73% of the children aged 5-11 years, in India, are suffering from anemia.[4] Prevalence of anemia in adolescent girls is 83%.[3] Verma M *et al.* reported a 51.5% prevalence of anemia among urban school children.[5] In present study high prevalence of anaemia may be due to lower socio economic status and poor nutritive food intake.

In this study, maximum children 108(54%) were from age group of 12-18 years. 92 (46%) were from age group of 6–12 years. According to age group wise haemoglobin (as per WHO guidelines), 138 children (69%) were found to be anaemic. Maximum anaemic children (57.24%) were from age group 12-18 yrs and 42.76% anaemic from 6-12 years. Recent study suggests that rapidly growing children require more nutrients to meet out growth requirements[7] that may be the reason why the highest prevalence of anaemia is seen in school going children and especially adolescents in the survey study also.

In the present study, 114 (57%) children were males and 86 (43%) children were females. Mean haemoglobin levels suggest that males (11.31gm/dl) had more haemoglobin than females (11.26gm/dl). (Observation table) Out of 138 anaemic children 76 (56.28%) were males and 62 (44.92%) were females. Mean haemoglobin value in anaemic children suggests that females (10.57gm/dl) had little low haemoglobin levels than males (10.60 gm /dl) (Observation table). This type of pattern was observed in present survey. Adolescent female children had less haemoglobin levels due to menstrual blood loss. Iron deficiency is significantly more prevalent among girls of lower socio-

economic status which is further augmented by rapid physical growth.[8] Poor dietary intake may also be a cause of high prevalence of anaemia in females. Heavy bleeding in menstruating female children causes iron deficiency but in present study negligible number of heavy bleeding menstruating female were registered and maximum were non menstruating hence almost equal haemoglobin value is found. Iron deficiency anaemia is predominant in females (2.14:1) during adolescent age.[9]

Only a single volunteer in the present survey study was non-Hindu. This may be due to predominance of Hindu population in this region. (Observation table) In this survey, maximum children 164 (82%) were from middle socio-economic class families while 32 (16%) were from lower socio-economic families. Least mean haemoglobin value is seen in children of lower socio-economic status (Observation table). This finding may be attributed to the poor nutritional value of the diet in this segment of society.

Presently anaemia can no longer to be considered as disease of poor. Recent data suggests that higher incidence of anaemia was found in middle socio-economic class (78.26%) and lower socio-economic class (20.28%). This data shows that anaemia is no more a disease of affluent society. Prevalence of disease is now rapidly increasing in middle and upper class also. Our study also suggest that least mean haemoglobin value is seen in lower socio-economic class children (10.94gm/dl) followed by 11.3gm/dl in middle socioeconomic class children.[10] (Observation table). In present survey, 162 (81%) children were delivered by normal spontaneous vaginal delivery (NSVD) while 39 (19%) by lower segment cesarean section (LSCS). In this study only 17.39% anaemic children were delivered by LSCS and rests were by NSVD. Haemoglobin value was little bit lower in case of children delivered by LSCS (Observation table). Cesarean delivery is likely associated with anemia in children, which suggests a possible need for exploring changes in obstetric care that might prevent anemia in cesarean delivered children. Cesarean delivery may reduce placental-fetal transfusion and thus increase the risk of early childhood anemia compared with vaginal delivery.[11]

In 61 (30.5%) patients, birth weight was observed low. More than 2.5kg weight was observed in 129 (69.5%). The mean haemoglobin value was greater in children who born with more than 2.5kg birth weight. (Observation table) A history of low birth weight may be an indicator of risk of anemia because more encouragement is required to implement iron supplementation in the low birth weight infants.[12] Low birth weight infants are generally considered a risk group for iron deficiency anaemia due to low iron stores at birth.

In present survey study 173 (86.5%) children had history of exclusive breast feeding till 6 months of age while in 27 (13.5%) children had no history of exclusive breast feeding. (Observation table) 111 (80.4%) anaemic children had history of exclusive breast feeding till 6 months of age while 27 (19.5%) patients had no history of exclusive breast feeding. This study gives the different view on first 6 month feeding pattern and haemoglobin value. Exclusive breast fed children were having mean haemoglobin value slight higher than those children who were given artificial feeding. (Observation table) Study suggests that an inappropriately high intake of cow's milk can also lead to anaemia. Exclusive breast feeding leads to a better gastrointestinal condition probably due to better immunity. Hence, exclusive breast fed children were having more haemoglobin value than children on artificial or cow milk feeding.

In this survey, it was also observed that a comparatively less mean haemoglobin value is found in those children in whom history of delayed walking was present. While it was more in those who started walking within normal duration after birth (Observation table). This trend was observed in anaemic children also. We observed 57 (41.3%) and 75 (54.34%) children as early stepping and moderate stepping time with mean haemoglobin 10.93gm/dl and 10.4gm/dl respectively. While delayed stepping was also noticed in 6 (4.34%) children but mean haemoglobin value was 9.7gm/dl (Observation table). The study reveals that motor development is sensitive to nutritional factors.[13] Anemic and/or iron-deficient children were found to perform poorly compared with their non-anaemic peers on the Bayley Scales of Infant Development motor scale and school-aged tests of motor development.[14-16]

Most of the children 114 (57%) in the present study had average school performance and mean haemoglobin 11.28gm/dl while 59 (29.5%) had very good school performance. only 12 (6%) children had poor school performance. It's clear from survey that anaemic patients having mean haemoglobin value 11.53gm/dl and 11.28gm/dl had very good and average school performance respectively. On the other hand school performance was poor in those study subjects who had a low haemoglobin level (10.05gm/dl) (Observation table). Most of the patients 77 (55.79%) were average school performing with mean haemoglobin 10.58gm/dl while 39 (28.28%) were with high school performance. The interesting fact observed in the present study suggests that poor school performance may be some linkage with haemoglobin level.

Balanced diet is important for proper physical and mental growth and development. In case of malnutrition, chances of anemia are more and hence school performance may go down. Their cognitive performance seems to improve with iron therapy.[17]

If a child gets diseased twice or thrice in quarter of year then it was assumed that his/her immunity is not good. With the mean haemoglobin value 10.56gm/dl, total 50 (25%) children were having weak immunity while rest i.e. 150 (75%) were having good immunity with mean haemoglobin value 11.53gm/dl. (Observation table) The interpretation of date of anaemic children also reflects the similar trends. Mean haemoglobin value 10.77gm/dl, 96 (69.56%) children were having stronger immunity while rest i.e. 42 (30.43%) were having weak immunity with mean haemoglobin value 10.61 (gm/dl). (Observation table) Anemic children were two times more susceptible to lower respiratory tract infection compared to the non anaemic children.[18]

170 (85%) children were getting dewormification at every 6 months and only 30 (15%) had no history of dewormification (Observation table). In anaemic children 81.81% had dewormification history and their haemoglobin value was higher in comparison to those who had no dewormification history in past 6 months. (Observation table) In India and other tropical countries worm infection and idiopathic tropical malabsorption have a high prevalence. These patients usually belong to a low socio-economic class, are poorly nourished and have moderate to severe anaemia.[19] Hence, less haemoglobin value is seen in improper dewormificated children.

In the present study, 61.5% children had poor appetite, 23% had increased appetite while only 23% were having normal appetite. (Observation table) Among anaemic subjects, 70.28% patients had poor appetite, 9.4% had increased appetite and 20.28% had normal appetite. (Observation table) The haemoglobin value of normal appetite children or patient was found less than those who were having disturbed appetite. Mean haemoglobin was slightly lesser in case of subjects with poor appetite when compared with increased appetite subjects. Studies also suggest that iron supplemented school children reported a positive effect on growth and appetite that was significantly better than in children who were receiving the placebo.[20]

In the survey, maximum children 97.5% were observed to have regular bowel habit with mean haemoglobin 11.63gm/dl. But mean haemoglobin value is found 9.88gm/dl in 2.5% children with irregular bowel habit. (Observation table) 94.92% Anaemic children were observed to have regular bowel habit with mean haemoglobin 10.59gm/dl while mean haemoglobin value is found 10.50gm/dl in 5.07% anaemic children with irregular bowel habit. It was slightly less than those who were having irregular bowel habit. (Observation table) Irregular bowel movements and indigestion also have been reported in anemic patients.[21]

In this survey, most of the children 146 (73%) were enjoying mixed diet and mean haemoglobin value 11.41gm/dl while rest of the children 54 (27%) were vegetarians with mean haemoglobin value 10.97gm/dl. (Observation table). Most of the anaemic children 68.84% were enjoying mixed diet and mean haemoglobin value 10.71gm/dl while rest 31.15% were vegetarians with lesser mean haemoglobin value i.e. 10.30gm/dl. (Observation table). It is clear from both tables that vegetarians were having low haemoglobin value. Restricted energy intake, impaired growth, and vitamin B12 deficiency can result from vegetarian diets of children.[22] It has been suggested that iron nutrition in vegetarians may not be optimal because: (a) because haem iron is more readily absorbed than non-haem iron; (b) because meat enhances non-haem iron absorption via the as-yet-unidentified 'meat factor'; (c) because vegetarian diets generally contain higher quantities of inhibitors of iron absorption, for example, phytate, tannins and Ca (Hallberg & Hulthen, 2000). In some cases, the prevalence of Fe-deficiency anaemia is similar to that of omnivores (Nelson et al. 1994), whereas other studies report lower Hb concentrations in vegetarians (Nathan et al. 1996).[23]

86 female were present in this study out of them 21female children (24.41%) had attained menarche and their mean haemoglobin value was 10.30 gm/dl. 65 female children (75.59%) in the present study had not attained menarche and their mean haemoglobin levels were 11.40gm/dl. (Observation table) 53 female were present in this study out of them 9 female children (16.98%) had attained menarche and their mean haemoglobin value was 10.04 gm/dl. 44 female children (83.01%) in the present study had not attained menarche and their mean haemoglobin levels were 10.86gm/dl. (Observation table) 21 females (81%) were with normal or less blood loss during menstruation and their mean haemoglobin value was 10.28gm/dl while excess bleeding was noticed in only 19% females with low mean haemoglobin value 9.8 gm/dl. (Observation table) Same pattern was observed among anaemic female children also. Among 9 females, 55.56% had normal or less blood loss during menstruation and mean haemoglobin value was 10.11 gm/dl while excess bleeding was noticed in

only 44.44% females with mean haemoglobin value 9.6gm/dl (Observation table). Menstruation, particularly when perceived as 'heavy', was the main risk factor for anemia and iron deficiency anaemia identified in girls.[24]

In the survey, sound sleep was present in 173 (86.5%) children while 27 (13.5 %) had disturbed sleep. Mean haemoglobin value in children having disturbed sleep was less than children having normal sleep. (Observation table) Same pattern was also present in anaemic children. 84.05% anaemic children while 15.95% had disturbed sleep (Observation table). In mild case of anaemia patients feels sleepier while in case of severe anaemia due to leg cramps patients had disturbed sleep. Poorer quality of sleep, decreased sleep time is found in patients which are sufferer of IDA-RLS (Restless Leg Syndrome) compared to patients with iron deficiency anaemia without RLS.[25]

In present study, 154 (77%) subjects gave the history of no palpitation and their mean haemoglobin was 11.56gm/dl. 30 children (15%) had palpitation on doing routine physical activity. Their mean haemoglobin value was 9.6gm/dl. Only 16 (8%) subjects gave the history of palpitation on doing strenuous physical activity and their haemoglobin was 10.36gm/dl. (Observation table) In anaemic children, 98 (71.01%) gave the history of no palpitation and their mean haemoglobin was 10.75gm/dl. 28 children (20.28%) had palpitation on doing routine physical activity. Their mean haemoglobin value was 9.08gm/dl. Only 12 (8.69%) gave history of palpitation on doing strenuous physical activity and their haemoglobin was 10.51gm/dl. (Observation table) Survey suggests that children having lesser haemoglobin concentration were feeling palpitation. Oxygen carrying capacity decreases due to decreased haemoglobin and as a result of which heart starts to pump rapidly to overcome hypoxic condition.[26]

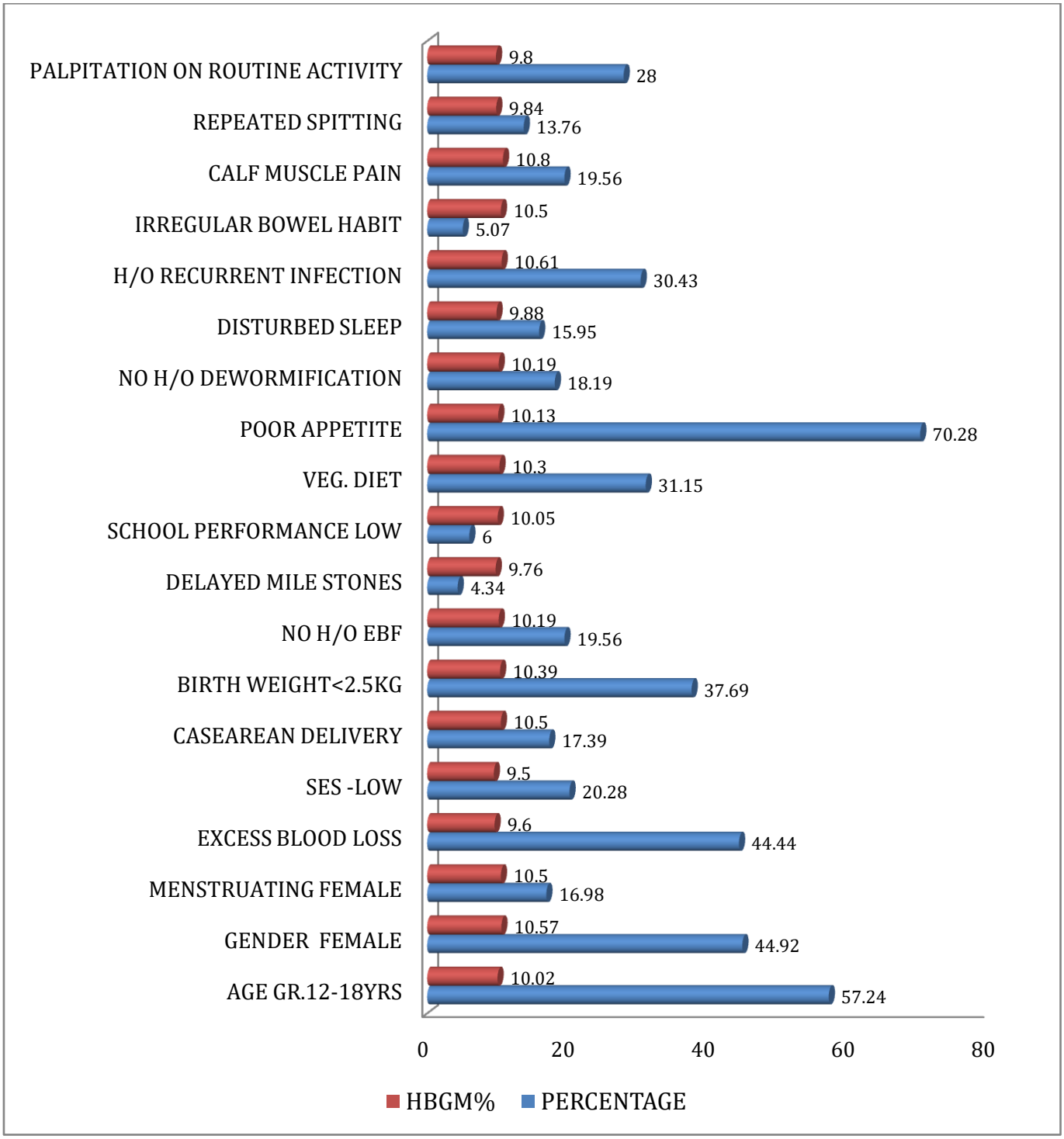
In present study, 154 (77%) subjects had no history of pica and their mean haemoglobin was 11.56gm/dl. 44 children (23%) had history of pica. Their mean haemoglobin value was 10.43gm/dl. (Observation table) In anaemic children, 32 (23.19%) gave the history of pica and their mean haemoglobin was 10.20gm/dl whereas 106 children (76.81%) had no history of pica. Their mean haemoglobin value was 10.68gm/dl. (Observation table) According to theory for pica is micronutrient deficiency theory, patients taste towards the deficient material changes. Ayurvedic literature suggests that body demands its deficient material itself too. A unique symptom of *Pandu roga* has been mentioned in Ayurvedic texts as "*Stheevana"* i.e. excessive spitting*.* In this survey, repeated spitting habit is observed in only 19 (9.5%) of total 200 children but mean haemoglobin value was 9.84gm/dl. Rest of the children 181 (90.5%) were not having repeated spitting and their mean haemoglobin value was 11.44gm/dl (Observation table). In anaemic children, it is observed that in 13.76% children with mean haemoglobin value was 9.84gm/dl had history of excessive spitting and rest of the children i.e. 86.23% having mean haemoglobin value 10.78gm/dl had no history of excessive spitting. Low haemoglobin value is found in anaemic children those complaints of repeated spitting. (Observation table) 173 children (86.5%) had no complaint of calf muscle pain and their mean haemoglobin value was 11.96gm/dl. On the other hand only 27 (13.5%) children had complaint of calf muscle pain and mean haemoglobin value 10.08gm/dl (Observation table). 79.71% anaemic children had no complaint of calf muscle pain with mean haemoglobin value 10.71gm/dl. Only 19.5% were with complain of calf muscle pain and mean haemoglobin value 10.08gm/dl. (Observation table) This survey revealed that all the children having leg cramps were having low haemoglobin value. The muscles of calf or foot suddenly become hard, tight, and painful; it is due to poor blood circulation in legs.[27]

40% children which were surveyed had participated in any anemia control programme or got iron supplements while 60% subjects did not give history of iron supplementation (Observation table). 90 (65.21%) anaemic children had earlier participated in any programme related to anemia while 48 (34.78%) did not participated in such programme. The mean haemoglobin value was 10.53gm/dl and 10.96gm/dl in both groups respectively (Observation table). Which was almost same in both segments; rather the subsets of subjects which did not give any history of previous iron supplementation through some anaemia prevention programme had little higher mean haemoglobin value.

The common clinical features observed in anaemic children (138) in present study were pallor skin and conjunctiva (100%), decreased appetite (79.7%), shortness of breath (28.99%), pica (23.19%), calf muscle pain (19.56%), disturbed sleep (14.94%), repeated spitting (13.76%), poor school performance (8.69%), irregular bowel habit (5.07%) and delayed mile stones (4.34%). In this study, the important determinates of anaemia were observed as adolescent age (52%), female (44.92%), lower socio-economic status (20.28%), menstruation (6.5%), low birth weight (37.69%), not having history of exclusive breast feeding (19.56%), lower segment caesarean section delivery (17.39%), no history of

dewormification (18.11%), vegetarian diet (31.15%) and history of long illness (5.07%).

Fig.: Common symptoms and risk factors of anaemia (n=138)



CONCLUSION

The high prevalence of anaemia and the risk factors of anaemia attributable to anaemia, indicate the importance of proper education regarding early feeding of baby as well as balanced diet for infants and children in this rural and urban population. The overall prevalence anaemia among school going children of district Kangra was found to be 69%. The major risk factors which were observed in present study were nutrition, socio-economic status, pica and dewormification

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