

## Original Research Article

# Clinical assessment of micronutrient deficiencies among children (1- 5 years) enrolled in anganwadis of old Hubli slums, Karnataka, India

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## ABSTRACT

**Background:** Micronutrients are vitamins and minerals required in small amounts that are essential to our health, development, and growth. As tiny as the amounts are, however, the consequences of their absence are severe. Iodine, vitamin A and iron are most important in global public health terms; their lack represents a major threat to the health and development, particularly children and pregnant women in low-income countries. The objectives were to clinically evaluate micronutrient deficiencies among children aged 1-5 years enrolled in anganwadi's of old Hubli.

**Methods:** A community-based cross-sectional study was carried out on 100 children enrolled in the anganwadis of Hubli slums for signs and symptoms of micronutrient deficiency.

**Results:** Pallor was found in 78% children and delayed developmental milestones in 20% followed by delayed eruption of teeth in 17%. Among the studied group 37% had dry hair and dry skin. Vitamin A, B, C, D deficiency was seen in 1%, 29%, 14%, 38% respectively.

**Conclusions:** The study concludes micronutrient deficiencies are prevalent among preschool children more so in with higher birth order having partial immunization. This appeals effective implementation of national health programmes, which can play a crucial role in addressing the hidden hunger. Correcting micronutrient deficiencies can significantly reduce childhood mortality and morbidity.

**Keywords:** Micronutrient deficiency, Prevalence, Signs and symptoms

## INTRODUCTION

Despite numerous advances and improvements in child health, malnutrition still remains as one of the main public health challenges of the 21st century, particularly in developing countries.<sup>1,2</sup> It undermines the survival, growth and development of children and is associated with almost 35% of all deaths in children under the age of 5 years worldwide.<sup>3</sup> An estimated 178 million children are stunted globally and an additional 19 million children have severe acute malnutrition (wasting).<sup>3</sup> Many of these conditions are associated with concomitant micronutrient

deficiencies and among them vitamin A, iron, zinc and iodine deficiencies are the most prevalent in childhood.<sup>4</sup> Globally, more than 2 billion persons have micronutrient deficiencies, most of them from developing countries. More than 70% of pre-school children consume less than 50% of the RDAs for vitamin A, iron, folic acid and riboflavin.<sup>5</sup>

Micronutrient deficiencies impair intelligence, strength and energy, sapping individuals of much of the needed vitality, productivity and initiative for economic development.<sup>6</sup> Micronutrient deficiencies negatively

affect child survival, growth, brain development, educational achievement and resistance to illness.<sup>7</sup> Micronutrient deficiencies result from inadequate dietary intake, poor absorption of nutrients, excessive losses, increased requirement or a combination of these factors.

Iron deficiency anaemia impairs cognitive performance, behaviour and physical growth in infants, preschool and school aged children. It adversely affects the immune status and increases the risk of morbidity.<sup>8</sup> Vitamin A has been termed an anti-infectious agent, and it plays an important role in the visual system.<sup>9-11</sup> Vitamin A deficiency (VAD) impairs numerous body functions and can lead to many adverse health consequences including xerophthalmia (dry eyes), infectious morbidity, mortality, suboptimal physical growth and anemia.<sup>9,12</sup>

Iodine is an essential micronutrient for normal growth and development in humans. Iodine deficiency is the most common cause of preventable mental retardation in the world today. Iodine deficiency causes goiter, impaired brain development in the fetus and infant and retarded physical and psychomotor development in the child. The deficiency also impairs children's learning ability.<sup>8</sup>

Zinc is a micronutrient essential for growth, development, and proper immune function. Zinc is now recognized as a major cause of stunting among children <5 years of age.<sup>13</sup> Zinc reduces both the incidence and the severity of diarrhea.<sup>13</sup> Addressing zinc deficiencies can reduce incidence of diarrhea by 27%, respiratory infections by 15% and overall mortality by 6%.<sup>14</sup>

Correcting micronutrient deficiencies in vulnerable populations can improve population-wide IQ by 10-15 IQ points; reduce maternal deaths by one-third, decrease infant and childhood mortality by 40% and increase strength and work capacity by 40%. It eliminates nutritional blindness and endemic cretinism and significantly reduces birth defects, stillbirths and congenital deafness.<sup>6</sup>

We thus aim to clinically evaluate micronutrient deficiencies among children aged 1-5 years enrolled in anganwadi's of old Hubli.

## METHODS

A cross-sectional study was done on 100 children aged between 1-5 years enrolled in the anganwadis of Urban Health Training Centre area of Department of Community Medicine, KIMS, Hubli in the month of August-November 2014 using a predesigned, pretested performa. 10 Anganwadis and 100 children aged 1-5 years were randomly selected. Children, who were sick, not present on the day of study, aged less than 1 year or more than 5 years were excluded. Informed consent was taken from their caregivers. History of symptoms of micronutrient deficiencies were collected from caregiver

and child. The children were examined for signs. Information regarding immunization and birth details was also collected from the "Thayi card" (mother child protection card). Anthropometric measurements were taken to assess concomitant macronutrient deficiencies. Salter weighing scale (min 100 g) and stadiometer (min 1mm) was used as tools of measurements.

Iron deficiency was assessed using history of easy fatigability, pica, passage of worms in the stools and by looking for pallor in the lower palpebral conjunctiva, palms, nail beds and tongue. History of easy fatigability was elicited from the caregiver by comparing the activities of the child with his peers of the same age and sex group. Pica is the persistent ingestion of non-nutritive substances like plaster, charcoal, paint and soil for a month in a manner that is inappropriate for the developmental level and not a part of culturally sanctioned practice.<sup>15</sup> Pica and passage of worms were enquired from the caregivers.

Iodine deficiency was assessed by eliciting history of delayed gross developmental milestones, delayed dentition and examining for goiter. Developmental assessment was done using windows of achievement of six major milestones.<sup>16</sup> Clinical assessment of zinc using clinical features is difficult but an attempt was made to estimate the burden by using stunting as proxy for zinc deficiency. Vitamin A deficiency was assessed by history of night blindness, presence of bitot's spots and conjunctival xerosis. Vitamin B and C deficiency was elicited by looking for angular stomatitis, cheilosis, glossitis, mouth sores, bleeding gums, perifollicular hemorrhages and history of prolonged bleeding and delayed healing.

Vitamin D deficiency was estimated by looking for features suggestive of rickets such as frontal bossing, bow legs, ricketary rosary etc.

Undernutrition and stunting was assessed using WHO growth charts.<sup>17</sup> The data was analyzed using Statistical Package for Social Sciences (SPSS) version 20. The percentage proportion of micronutrient deficiencies was analyzed as per age group and gender.

## RESULTS

The study was done on 100 children aged 1-5 years hailing from urban background and belonging to low socioeconomic families as per Modified Kuppuswamy Classification.<sup>18</sup> The distribution of girls and boys was 58 and 42 respectively. 34 children belonged to Hindu families and 66 to Muslim families. Among 100 children, 97 had institution delivery. Immunization coverage was 90%. Among the caregivers interviewed, 18 were illiterate, 36 had attended school upto or less than 7<sup>th</sup> standard, 34 had completed SSLC and 12 had been to college. For application of significance test, children were grouped based on birth weight, age and birth order

into Low Birth Weight (10%), Very Low Birth Weight(3%), normal birth weight children (86%) and birth weight not recorded(1%), age groups of 1-2 years

(27%), 2-3 years (28%), 3-4 years(20%) and 4-5 years (25%) and Birth order groups of 1<sup>st</sup> (42%), 2<sup>nd</sup> (48%), 3<sup>rd</sup> (11%) and 4<sup>th</sup> (1%) respectively.

**Table1: Features of micronutrient deficiency.**

Features of	Criteria	Boys	Girls	Total	Comment
Iron deficiency	Easy fatigability	15	19	34	Pallor is the most common symptom seen in 78% followed by easy fatigability 34%.
	Pica	9	8	17	
	H/O passage of worms in stools	3	5	8	
	Pallor	32	46	78	
Iodine deficiency	Developmental delay	10	10	20	Developmental delay was seen in 20% of the children. Goiter was found in only 1 child
	Delayed dentition	10	7	17	
	Goiter	1	0	1	
Vitamin deficiency	Vitamin A	0	1	1	Vitamin D deficiency was the most prevalent in the study sample.
	Vitamin B	12	17	29	
	Vitamin C	4	10	14	
	Vitamin D	13	25	38	
Stunting (weight for height using z scores )	Normal ( Median to 2SD)	14	24	38	Stunting is seen in 62% children with higher prevalence in girls.
	Moderate (2SD-3SD)	14	16	30	
	Severe (More than 3 SD)	14	18	32	

**Table 2: Demographic profile of micronutrient deficiency.**

		Fatiguability	Pica	Worms	Pallor	Delayed milestones	Delayed dentition	Dry hair and skin	Vitamin A	Vitamin B	Vitamin C	Vitamin D	Total
Age group	1-2 years	8	7	1	21	6	8	10	0	7	4	15	27
	2-3 years	9	6	1	24	4	4	13	0	11	6	11	28
	3-4 years	6	2	3	14	5	3	4	1	7	3	4	20
	4-5 years	11	2	3	19	5	2	9	0	4	1	8	25
Religion	Hindu	11	5	2	28	10	7	13	0	8	5	11	34
	Muslim	23	12	6	50	10	10	23	1	21	9	27	66
Education	Not educated	9	5	1	15	4	2	7	1	5	3	8	18
	Middle school	11	6	4	27	8	5	16	0	12	3	16	36
	High school	13	5	1	28	5	7	8	0	10	6	12	34
	Higher education	1	1	2	8	3	3	5	0	2	2	2	12
	Total	34	17	8	78	20	17	36	1	29	14	38	100
Birth weight	Normal	38	13	7	68	16	11	30	1	26	12	31	86
	Lbw	4	3	1	10	2	4	5	0	2	2	5	10
	Vlbw	1	1	0	2	2	2	1	0	1	0	2	3
Immunization status	Complete	30	16	8	68	18	15	29	0	24	10	31	90
	Partial	4	1	0	10	2	2	7	1	5	4	7	10
Birth order	1 <sup>St</sup>	18	6	5	30	6	8	16	1	13	6	16	42
	2 <sup>nd</sup>	13	9	3	38	11	8	17	0	13	6	15	48
	3 <sup>rd</sup>	3	2	0	9	3	1	2	0	2	1	6	11
	4 <sup>th</sup>	0	0	0	1	0	0	1	0	1	1	1	1

In this study, 34% children had complaints of easy fatigability, 17% had pica, 8% had h/o passage of worms in stools and 78% had clinical pallor. 20% had h/o delayed attainment of gross developmental milestones and 17% had delayed dentition. 1 child had grade 1 goiter. Dry hair and dry skin were seen in 36%. Dental caries were seen in 10%. Features suggestive of Vitamin A, B, C and D deficiency was seen in 1%, 29%, 14% and 38% respectively. The proportion of under nutrition was 59%. Stunting was seen in 62% and wasting in 70% of children (Table 1 and Table 2).

## DISCUSSION

The present study was done to estimate the burden of micronutrient deficiency in children of Hubli slums. Proportion of Bitot's spots, the objective sign of clinical Vitamin A Deficiency, was higher than the WHO cut-off point of 0.5, indicating it to be a public health problem. The prevalence was higher compared to the figures reported for pre-school children of rural India (0.8%) by NNMB (2006), Sachdeva, et al reported the prevalence of clinical VAD and various determining factors associated with the high prevalence of VAD (9.1%) among pre-school children of Aligarh district, Uttar Pradesh.<sup>19,20</sup> Arlappa N reported the prevalence of Bitot's spots as 5.4% and night blindness as 2.8%<sup>21</sup>

In the case of anaemia, prevalence (78%) was similar to that reported in NFHS 3, 2005-2006 (70%), indicating the magnitude of the problem to be of 'severe public health significance'. The prevalence of pallor was also higher than that found by Bhatia et al (58%) and Verma M et al (55%).<sup>22,23</sup> H/o passage of worms in stools was found in 8% which was lower than that observed in by Bhatia et al (35%). Although prevalence of worm infestation is confirmed either by history of passing worms or by examination of stool, present study used history of passing worms and pica with or without abdominal pain as criteria for worm infestation. Universal deworming of children has been recommended because of its high prevalence.<sup>22</sup>

In this study the prevalence of micronutrient deficiencies was found to be higher in partially immunized children indicating a protective action of vitamin supplementation. Children with higher birth order showed higher prevalence of micronutrient deficiencies. Deficiencies were not affected by age groups and religious background. However prevalence was affected by educational status of caregivers indicating better nutritional awareness. Birth weight also had a role in micronutrient prevalence with more prevalence in low birth weight babies.

The major contributing factors for high prevalence of micronutrient deficiencies are low intake of micronutrient dense foods, poor purchasing power resulting from ever increasing food prices and ignorance of nutritional problems.

## Limitations

- Only qualitative assessment of micronutrient deficiency was done.
- Biochemical assessment could not be done.

## CONCLUSION

The study concludes that micronutrient deficiencies are prevalent among preschool children, more so in those with higher birth order, having partial immunization. This appeals effective implementation of National Health Programmes' which can play a crucial role in addressing the hidden hunger.

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