ORIGINAL ARTICLE
ASSESSMENT OF CHILDREN PRESENTING WITH HISTORY OF PICA FOR IRON DEFICIENCY ANAEMIA BY SERUM FERRITIN ESTIMATION

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Background: Pica is persistent ingestion of non-nutritive substances for at least one month mostly after the age of 2 years. Pica is common presentation of iron deficiency anaemia. This study aimed to assess children for iron deficiency anaemia presenting with history of pica by serum ferritin estimation. **Methods:** This study was done over one year in Ayub Teaching Hospital, Abbottabad. Children of either sex above two years presenting with history of pica were included. Patient history of pica substance and nutrition along with milk intake, age, sex, weight, height, was documented on proforma. Data was analysed on SPSS-20 and results were taken significant with $p<0.05$. **Results:** A total of 120 patients, 59 (49.2%) males and 61 (50.8%) females, were recruited. Their age range was 2–10 years; weight ranged 6.8–40 Kg with mean weight 12.55±3.43 Kg. Height ranged from 70.5 to 154 Cm with mean height 90.5±10.48 Cm. Haemoglobin ranged from 5.3 to 11.9 gm/dl with mean Hb 8.81±1.21 gm/dl. Mean serum ferritin level was 7.3±4.28 ηg/ml. Substances eaten were soil, sand and lime accounting for 72.5%. Twenty percent children were breast fed. There was significant relationship between weight and height with pica ($p<0.001$). **Conclusion:** Pica is one of the common presentations of iron deficiency anaemia and most of the parents ignore this as if this is not manifestation of disease, rather consider it to be habit of child. Any child presenting with pica history should be evaluated for iron deficiency anaemia.

Keywords: pica, anaemia, children, ferritin, serum

INTRODUCTION

Anemia, being a major public health problem has affected both developed and underdeveloped countries. In 1980, the World Health Organization (WHO) estimated about 700 million people throughout the world was affected by anaemia. According to WHO, anaemia is one of the commonest preventable cause of death under 5 years' children. About 50% of anaemia cases are due to iron deficiency, which is the most common malnutrition disorder.[1] The prevalence of iron deficiency anaemia is between 40–70% in Pakistanis' children under five year.[2,3] The most important causative factors include excessive milk consumption and delayed weaning with poor iron rich foods. Iron deficiency anaemia is associated with growth retardation, decreased cognition, learning disability and limited physical activity.[3]

The word 'Pica' has been derived from a Latin word, meaning Magpie, a bird capable of eating a variety of non-food items.[4] Pica is defined as 'persistent ingestion of non-nutritive substances for at least one month at an age when such behaviour is developmentally inappropriate'.[5] At least the age of 2 years is suggested for the diagnosis of pica because in younger children less than two years, the ingestion and mouthing of non-nutritive substances is common and is non-pathological.[6] In pica a wide variety of non-food substances are ingested like clay, dirt, sand, stones, salt, ice, pebbles, hair, lead, laundry starch, vinyl gloves, plastic, pencil erasers, powders, creams, fingernails, paper, paint chips, coal, chalk, wood, plaster, light bulbs, needles, string, cigarette butts, wire, and burnt matches.[7] Different terminology are used for ingestion of different objects like ingesting ice cubes (pagophagia), clay (geophagia), dried pasta (amylophagia), chalk, starch, paste, Kayexalate resin (resinphagia).[8]

The exact cause of pica is unclear, but it is strongly associated with iron deficiency anaemia. When it is associated with iron deficiency, it is believed that pica is an effect rather than a cause.[8,9] As iron deficiency may cause glossal pain, so patients with anaemia choose to chew ice for its analgesic properties but other pica substances do not have any known analgesic properties.[10] Different hypothesis exist about why iron deficiency causes pica but there is no single agreed upon explanation including physiological mechanism.[1,4] Pica as observed since antiquity, seems to be strongly associated with iron deficiency anaemia, and in majority cases it disappears upon iron supplementation.[6,8,10,11] There are many theories to explain the causes of pica. Earlier investigators proposed nutritional deficiencies as pica's cause like iron and zinc. This idea was rejected as many children who consume foam, paper and rubber as pica substances usually don't have any nutritional deficiencies. Other theories suggest psychological

problems, obsessive-compulsive disorders and family stresses as predisposing factors for pica. Usually pica is attributed only for texture and taste's enjoyment.[12] Pica is linked to different factors like age, gender, religion, culture, nutritional deficiency, stress, and mental development.[13]

Serum ferritin shows iron stores and is the most accurate diagnostic test for iron deficiency anaemia when mean corpuscular volume (MCV) is less than 75 μL.[14] Levels less than 25 ηg/ml are consistent with the diagnosis of iron deficiency anaemia.[15] Serum Ferritin greater than 100 ηg/mL generally exclude iron deficiency anaemia.[16] This study was done to assess the children for iron deficiency anaemia presenting with history of pica by estimation of serum ferritin level.

PATIENTS AND METHODS

This cross-sectional study was done in the Department of Paediatrics (B ward), Ayub Teaching Hospital, Abbottabad from July 2017 to June 2018. A total of 120 patients of either sex between 2 years to 10 years of age were included with history of pica after taking consent from either parent. Children with congenital anaemia, haemolytic anaemia, mental disabilities and behaviour problems were excluded. Information gathered included duration of pica, substances consumed perceived as pica and a detailed dietary history including age at weaning, amount of milk consumed per day. Weight and height were measured to assess general nutritional status along with parent's education were documented on proforma.

Data was analyzed on SPSS-20 and results were taken significant with $p<0.05$. Sample size was calculated with OpenEpi taking prevalence of pica as 90% in children with confidence interval of 95%.[17] Calculated sample size was 139 patients but only 120 patients could be included. Haemoglobin level of less than 11 gm/dl and/or serum ferritin less than 25 ηg/ml were considered as iron deficient state.[15]

Qualitative variables included sex, nutritional status and weaning practices along with pica substances. Substances were presented as frequency and percentages. Quantitative variables included age, weight, height, and amount of milk consumed per 24 hours, Haemoglobin level, MCV and serum ferritin level were expressed as mean and standard deviation.

RESULTS

A total of 120 patients with iron deficiency anaemia were included in the study, 61 (49.2%) girls (50.8%) and 59 (49.2%) boys. Mean age of patients was 3.09±1.40 years. Mean weight and height were 12.55±3.43 Kg and 90.50±10.48 Cm respectively. Mean Hb was 8.81±1.21 gm/dl. Mean serum ferritin level was 7.3±4.28 ηg/dl (Table 1).

The most common pica substances were soil, sand and lime accounting for 72.5%. We could not find

foams, salt and ice as pica in our patients. There was significant relationship between pica and non-breast feeding practices in children (p=0.04) as 96 (80%) children with pica were not taking breast milk while 24 (20%) were breastfed. There was also significant association between onsets of pica with the type of feeding of children (breastfeeding or artificial feeding) (p=0.035). Pica and age also had significant relationship ($p<0.001$). There was significant correlation of weight and height with pica ($p<0.001$).

Table-1: Anthropometric parameters, pica duration, haemoglobin, serum ferritin level in subjects (n=120)

Variables	Min	Max	Mean±SD
Age (Years)	1.10	10.00	3.05±1.43
Weight (Kg)	6.80	40.00	12.55±3.43
Height (Cm)	70.50	154.00	90.50±10.48
Pica duration (months)	1.00	60.00	8.82±9.77
Weaning age (months)	4.00	36.00	7.94±5.19
Daily Milk intake (L)	0.00	2.50	0.72±0.44
Hb (gm/dl)	5.30	11.90	8.81±1.21
MCV (fl)	49.80	93.30	61.70±7.01
Serum Ferritin level (ηg/ml)	0.10	26.46	7.31±4.28

DISCUSSION

Anaemia being a major public health problem, has affected both developed and underdeveloped countries. Anaemia is the commonest preventable cause of death in children under 5 years and above 50% cases are due to iron deficiency.[1] Pica is defined as 'persistent ingestion of non-nutritive substances for at least 1 month at an age when such behaviour is developmentally inappropriate'.[5]

In our study, the age of children with pica ranged from 24 months to 10 years whereas in a study done in Egypt by El-Nemer et al[18] the age of children suffering from pica ranged from 20 to 72 months. Both studies show that pica starting age is above 1.5 year. At least, the age of 2 years is suggested for the diagnosis of pica because in younger children less than two years, the ingestion and mouthing of non-nutritive substances is common and is non-pathological.[6] Al-Joborae et al[19] found that the majority of childhood pica starts at the 1st year of life or older (65.3%), and under one year of age 34.7% with the mean age of 14.51±4.13 months. The mean age for pica in our study was 3.05 years as we enrolled only those patients with pica who were above 2 year. The other reason for this difference might be due to lack of knowledge and concern of parents about pica.

We did not find any association between gender and pica. We found 61 girls (50.8%) and 59 boys (49.2%). Similar findings were noted in a study by Ivascu et al[20] in America. Al-Joborae et al[18] found that 69.3% of patients were males and 30.7% of patients were females. Similar results were shown in studies from Iran[21] and Egypt[18] with male predominance.

The common types of materials in childhood pica in our study were soil, sand, and lime accounting

for 72.5%. This is similar to Al-Joborae *et al*[19] who reported clay, soil, stones, and dirt as types of material in childhood pica in 69.3% cases. The same results were observed in a study from Iran[21] where the common substances were soil, sand and lime accounting for 72.5%, and geophagia in 62.3%. In a study on Zambian[19] children, 74.4% practiced some form of geophagia which is comparable to our results. Similar findings were reported in a study from Egypt[17] where clay (43.1%) and dust (25.9%) were the most common types of pica substances.

In our study, there was a significant association between onset of pica with the type of feeding of children (breastfeeding or artificial feeding). Al-Joborae *et al*[19] found that two-thirds (68.7%) of children with pica were breastfed while the other one-third was artificially fed. This is close to our results, i.e., 80%. In comparison, a study by Gupta *et al*[22] reported that pica was seen more in bottle-fed children than breastfed children. This is in agreement with a study from Egypt[18] which found that pica was more in bottle-fed children (70.1%) as compared to breastfed children (29.9%). Results of both these studies are comparable to our results. Dietary factors were found to have major impact in the occurrence of iron deficiency anaemia as it was found to be more prevalent in children not consuming enough iron-rich food. There is significant relationship between pica and non-breast feeding practices in children; 80% children with pica are not taking breast milk while 20% are breastfed. These results are comparable to Paudel *et al*[23] where 31% of iron deficiency anaemia children were exclusively breastfed.

Pica had significant ($p<0.001$) correlation with age. Pica was highest in younger patients and its prevalence decreased with advancing age; same results were reported by Ivascu *et al*[20]. There was significant ($p<0.001$) relationship of pica with weight and height. Patients with pica had lower average weight in all age groups. Same results were also observed by Ivascu *et al*[20]. If pica was the cause it might be due to complications of pica like worm infestation and recurrent gastrointestinal infections. Whether pica was the effect or cause of lower weight could not be established by our data.

In our study haemoglobin ranged from 5.3 to 11.9 gm/dl with mean Hb 8.81±1.21 gm/dl as it is comparable to mean haemoglobin (7.96±1.1 gm/dl) in the study by Paudel *et al*[23]. Mean serum ferritin level was 7.3±4.28 ηg/ml. MCV ranged from 49.8 fl to 93.3 fl with mean of 61.69±7.01 which is similar as in the study of Paudel *et al*[22] where the average MCV was 58.16 fl.

In the study of Al-Joborae *et al*[19], the mean Hb was 8.44±1.50 gm/dl, ranging from 6 to 11.9 gm/dl, and mean serum ferritin was 6.36±1.54 ηg/ml, ranging from 3.7 to 11.0 which is close to our results. The results by

Bainton[24] showed mean MCV as 74 fl, and mean haemoglobin as 7.6 gm/dl in patients with iron deficiency anaemia, similar findings are there in our study. Geophagy is significantly associated with iron deficiency anaemia in our study and serum ferritin concentrations are negatively associated with geophagy. These results are comparable to a Western Kenya study.[25] In a meta-analysis by Miao *et al*[26], a significant association of pica with low Hb and low hematocrit was found as observed in our study. El-Nemer *et al*[18] found the mean Hb as 9.7±1.5 g/dl ranging from 6.70 to 12.80 and mean level of serum ferritin as 14.24±16.13 ηg/ml ranging from 4.20 to 55.10 ηg/ml, which was comparable to our study. Singhi *et al*[27] also found mean Hb and iron levels significantly lower in children suffering from pica. There was strong association between iron deficiency anaemia and pica which is due to malabsorption of iron from the diet due to pica. Al-Sawaf[28] also expressed the same results of low level of Hb and Ferritin associated with pica. Some studies[29] failed to find any association between pica and anaemia and/or iron deficiency. A double-blind controlled study[27] did not find any relationship between iron therapy and pica behaviour. This is probably because pica is more a cultural behaviour than a result of iron deficiency.

CONCLUSION

Pica is a common presentation of iron deficiency anaemia and most of the parents ignore this as if this is not a manifestation of disease, rather consider it to be habit of child. Pica is also present in older children having low serum ferritin levels. Any child presenting with pica history should also be investigated for iron deficiency anaemia.

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Contribution of Authors:
SN: Data collection, analysis, abstract
SSHS: Theme, data collection, analysis, discussion
BA: Data entry, literature search
SS: Data entry, literature search
A: Results, discussion
EH: Results, discussion