Original Research Article

Clinical profile, sociodemographic and biochemical determinants of PICA among 1 to 5 aged children attending a tertiary care hospital

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ABSTRACT

Background: The term PICA has been derived from the Latin word "MAGPIE" which is a bird that has omnivorous habit and is known for its indiscriminate preference for foods and non-foods. The aim of this study was to study the clinical profile and to determine the relationship between pica and various socio demographic determinants, serum levels of iron, zinc and calcium.

Methods: This study was conducted in 51 children with PICA belonging to 1-5 years and 51 controls of same age and sex who were attending pediatrics department in SRM medical college hospital and research centre. The data regarding clinical manifestations and sociodemographic determinants were collected by questionnaires to mother. The blood samples were collected from each child involved in the study after getting consent. Then the data was analyzed by using chi-square, unpaired 't' test and ANOVA analysis.

Results: This study shows that PICA is commonly seen in males, bottle fed children and those belonging to nuclear family. Family history of PICA had significant association with PICA in children (p=0.05). Soil is the most common type of pica (49%) followed by paper and stone. The most common presentation is poor appetite (43.1%). The serum levels of iron and zinc were significantly low when compared to controls (P <0.001). The serum levels of iron in anemic children with pica are also significantly lower than pica children with no anemia. No significant association is seen between serum iron and zinc with number of substances or duration of ingestion or frequency of ingestion (P >0.05).

Conclusions: Family history of PICA, bottle feeding, joint family has significant association with pica. Soil is the most common type of PICA. Poor appetite is the most common clinical manifestation. There is significant association between low serum levels of iron and zinc with PICA.

Keywords: PICA, Calcium, Iron, Mental retardation, Zinc

INTRODUCTION

To eat is a necessity, but to eat intelligently is an art. The term PICA has been derived from the Latin word "MAGPIE" which is a bird that has omnivorous habit and is known for its indiscriminate preference for foods and non-foods.[1] According to DSM-IV2 Pica is defined as "persistent and compulsive eating of non-nutritive substances for a period of at least one month, without an association with aversion of food." This behavior should be developmentally inappropriate.

There are many substances such as soil, ice, plaster, clay, charcoal, paper, paint etc. consumption of which is

considered as pica.[3] This may vary by ethnicity, culture, race and geographic region.

Pica is more prevalent than commonly believed, and the problem is also more widespread. Recent prevalence of pica was not known as no studies were available. According to previous studies pica has been described from all parts of the world with a prevalence varying from 10-32.5% of all the children surveyed and 73% among school children.[4-7] Pica has also been reported in children with autism, Mental retardation and also in Schizophrenic patients. There is also evidence of pica induced in animals like rats by iron deficiency, low calcium diet and toxins like lead etc.[8]

Eating habits in children tend to establish during the first 2 to 3 years of life. During childhood, the preference of eating and attitudes related to food habits established by family influences and culture. Various aetiologies have been proposed, ranging from psychosocial causes to biochemical causes. They include nutritional deficiencies (e.g., iron, zinc, and calcium), low socioeconomic factors, child abuse and neglect, family disorganisation (e.g., poor supervision), psychopathology, learned behaviour, underlying (but undetermined) biochemical disorder, and cultural and familial factors.[3] The Adverse effects of PICA ranges from toxicity (lead), obstruction, nutritional deprivation, excess calorie intake and parasitic infestations.[9,10]

The main goal of the treatment is to reduce and eliminate the habit of craving for non-food items and identifying the health emergency (whether the person is poisoned, has an intestinal blockage or obstruction) in order to save the patient's life. Management of pica involves behavioural, environmental, and family educational approaches.

Despite the widespread prevalence of pica and its association with multiple health issues, little is known about its causes and consequences. The aetiology is still a matter of debate. In India, very few researchers studied the association between pica and serum iron, zinc and calcium levels. There is also lack of literatures about clinical data of pica in our country, hence this observational case control study was done to observe the different clinical aspects of pica and to determine the association between pica and various socio demographic determinants and also relationship of pica with serum levels of Fe, Zn and Ca.

METHODS

This case control study was done in the Department of Paediatrics, SRM Medical College Hospital and Research Centre, Potheri, Chennai from August 2016 to August 2017. The study was started after getting the institutional ethical committee clearance (Ethics clearance number: 1198/IEC/2017). During that period after getting written informed consent from parents we could enroll all eligible 1-5 years old children (51 cases and 51 controls) for the study. At the beginning of the study cases and controls are differentiated based on history of PICA, then questionnaire is administered to mother/caretaker regarding the child's background in terms of mothers' education, current occupation, source of income, family size, residence, birth order, family history of pica, history of pica in mother during pregnancy, weaning practices etc. Also, mother/caretaker interviewed about pica characteristics like type of substance eaten (soil, paper, chalk, clay, starch etc.) age of onset, duration of ingestion, number and frequency of consumption of substances. Children were subjected to complete physical examination, assessment of anthropometry and any signs of malnutrition or nutritional deficiency.

Blood samples of 2 ml blood was collected into heparinized plain red topped vacationer tube using disposable plastic hubbed needles from a peripheral vein. Separate the serum by centrifuging at the rate of 2500-3000 rpm for 5-10 minutes.

On the same day sample has to be processed to estimate the serum levels of iron, zinc and calcium. Serum has to be separated if investigation was not done on same day and the sample has to be stored at 2 to 8°C for up to 3 weeks and 15 to 25°C for 7 days.

Inclusion criteria

- Children between 1-5 years who have been ingesting inedible substances 3 or more times per week for 3 months or more (cases)
- Healthy children 1-5 years who don't have pica, came for vaccination during the study period (controls).

Exclusion criteria

Children with Developmental delay, Thalassemia major, severe malnutrition (weight for age <60%, according to IAP classification).

Statistical analysis

The following results were analyzed using Chi-square test, Unpaired 't' test and ANOVA by using SSPS 17 version.

RESULTS

The study group consists of 51 cases and 51 controls. Controls are healthy children who came for immunization to the Paediatric Department of SRM Medical College were selected randomly.

In the present study the children were divided into 2 age groups (12-36 months and 37-60 months). Among cases 36 (70.6%) children belongs to 12-36 months and15 (29.4%) are of 37-60 months.

Table 1: Frequency of PICA characteristics in children.

Pica characteristics	N	Percentage
Age of onset		
<12 months	6	11.8
12-24months	37	72.5
>24 months	8	15.7
Duration of ingestion		
3-12 months	38	74.5
13-24 months	11	21.6
>24 months	2	3.9
No. of substances ingested		
1	8	15.7
2-3	42	82.4
4 and above	1	1.9
Frequency of ingestion		
<3/day	13	25.5
3-5/day	21	41.2
>5/day	17	33.3

Table 2: Comparison of demographics between cases and controls.

	Cases	Controls	P-value
Residence			
Semi-urban	33 (64.7%)	11 (21.6%)	0.124
Rural	18 (35.3%)	40 (78.4%)	
Mothers education			
No formal education	15 (29.4%)	8 (15.7%)	0.09
Literate	36 (70.6%)	43 (84.3%)	
Mothers occupation			
Housewife	47 (92.2%)	43 (84.3%)	0.219
Working	4 (7.8%)	8(15.7%)	
Socioeconomic status			
Upper	0 (0%)	0 (0%)	0.424
Middle	24 (47.1%)	20 (39.2%)	
Lower	27 (52.9%)	31 (60.8%)	
Family history of PICA			
Yes	6 (11.8%)	1 (2%)	0.050
No	45 (88.2%)	50 (98 %)	
Family size			
Joint	21 (41.2%)	33 (64.7%)	0.017
Nuclear	30 (58.8%)	18 (35.3%)	
Complementary feeds at appropriate age			
Yes	45 (88.2%)	47 (92.2%)	0.505
No	6 (11.8%)	4 (7.8%)	
Dietary history			
Bottle feeding	15 (29.4%)	7 (13.7%)	0.054
Breast feeding	36 (70.5%)	44 (86.2%)	
Birth order			
First	20 (39.2%)	14 (27.5%)	0.411
Second	30 (58.8%)	35 (68.6%)	
Third and above	1 (2%)	2 (3.9%)	

Among controls 35 (69.6%) children belongs to 12-36 months and 16 (31.4%0) belongs to 37-60 months. Majority of the children falls under 12-36 months in both the groups. In pica group mean age is 30.6±13.8 where as in control group it is 32.29±14.10.

There were about 33 (64.7%) males and 18 (35.3%) females in pica group whereas 30 (58.8%) males and 21 (41.25%) females in control group. Both the males and females are almost equally distributed among both groups. In the present study the mean weight, height and MAC in cases are 11.44, 90.06 and 14.62 where as in controls they are 12.1, 92.32 and 15.17 respectively.

Table 1 shows that most of the children have pica at the age of 12-24 months 37 (72.5%). 38 (74.5%) children had pica for 3-12 months of duration and 42(82.4 %) of them ingest 2-3 substances at a frequency of 3-5 times per day 21 (41.2%). In the present study most commonly, ingested substance is soil 49% followed by paper (33.3%), stone (23.5%), chalk (21.6%) and plaster (17.6%). The remaining substances are ice (11.85), clay (9.8%), hair (9.8%), cloth and pencil (7.8%), starch and soap (5.9%), (faeces 2%), others (3.9%).

The above Table 2 showed type of family has statistically significant association with pica (P=0.017), whereas residence, mother's occupation, socioeconomic status, complimentary feeds not started at appropriate age and birth order has no statistically significant association with pica. Family history of pica has almost statistical significance (p-0.05). Bottle feeding also has some significance. Mother's education has barely detectable statistical significance (P = 0.09).

Table 3: Distribution of iron, zinc and calcium among cases and controls.

		Cases	Controls	P-value
Grading of anemia	No anemia	9 (17.6%)	35 (68.6%)	0.000
	Mild	12 (23.5%)	11 (21.6%)	
	Moderate	27 (52.9%)	5 (9.8%)	
	Severe	3 (5.9%)	0 (0%)	
Serum iron	Normal	10 (19.6%)	39 (76.5%)	0.000
	Low	41 (80.4%)	12 (23.5%)	
Serum zinc	Normal	40 (78.4%)	51 (100%)	0.000
	Low	11 (21.6%)	0 (0%)	
Serum calcium	Normal	49 (96.1%)	51 (100%)	0.153
	Low	2 (3.9%)	0 (0%)	

In this study most of the children present with poor appetite 22 (43.1%), followed by pain abdomen and cough 14 (27.5%), then vomiting 13 (25.5%), diarrhea 7 (13.7%) and only 4 (7.8%) shows perianal itching. Table 3 showed that most of the children with pica 42 (82.3%) had anemia, 11 (21.6%) had low zinc values and 2 (3.9%) had low calcium. There is statistically significant relationship between anemia, serum iron, serum zinc and pica (P <0.001). But no statistically significant difference between calcium and pica.

Table 4: Mean for Hb, serum iron, zinc and calcium in cases and controls.

	Cases		Controls			
	Mean	**Sd**	**Mean**	**Sd**	**T-value**	**Sig. (2-tailed)**
Hb	9.38	1.55	11.68	1.20	-8.335	0.0001
Serun iron	31.27	20.68	66.92	24.31	-7.974	0.000
Serum zinc	74.68	19.26	86.29	14.18	-3.466	0.001
Serum calcium	8.68	0.54	8.94	0.51	-2.490	0.014

Table 5: Serum iron in children with pica related to frequency of ingestion, no of substance eaten and duration of ingestion.

Serum Iron		N	Mean	SD	'F' statistic	P- value
Number of substances	Single	16	30.62	19.51	0.0212	0.884
	Multiple	35	31.54	21.45		
Duration of ingestion	<12 mon	38	29.05	18.96	1.296	0.260
	>12mon	13	36.38	23.02		
Frequency of ingestion	<3	13	34.30	17.98	0.6413	0.531
	3-5	21	33.14	25.08		
	>5	17	26.64	16.53		
Serum zinc						
Number of substances	Single	16	66.38	20.89	2.279	0.137
	Multiple	35	75.31	19.00		
Duration of ingestion	<12 mon	38	74.81	18.07	0.0073	0.932
	>12 mon	13	74.27	23.21		
Frequency of ingestion	<3	13	72.07	11.70	0.0154	0.854
	3-5	21	75.34	21.77		
	>5	17	75.85	21.37		

Table 6: Comparison of serum iron and zinc in children of pica with anaemia and without anaemia.

		Pica with anaemia (A)	Mild anaemia (B)	Moderate anaemia (C)	Severe anaemia (D)	F statistic	P-value
Serum Iron	N	9	12	27	3	8.6626	0.0001
	Mean	55.44	34.33	23.81	17		
	SD	22.97	15.35	15.53	14.79		
Serum Zinc	N	9	12	27	3	1.2399	0.3059
	Mean	78.82	75.21	75.82	54.23		
	SD	20.14	15.45	21.69	8.29		
Tukey HSD results for iron							
Pairs		**Tukey HSD p-value**		**P-value**			
A vs B		0.003		p <0.05			
A vs C		0.001		P <0.01			
A vs D		0.007		P <0.01			
B vs C		0.292		Insignificant			
Bvs D		0.399		Insignificant			
Cvs D		0.899		Insignificant			

Table 4 showed that the mean of Hb, serum iron, zinc and calcium in cases are 9.38%, 31.27%, 74.68 and 8.68 where as in controls they are 11.68, 66.92, 86.29 and 8.94 respectively. The mean values of Hb, iron, zinc and calcium are low than the control group. All the parameters were significantly low in cases when compared to controls (P<0.05)

Table 5 showed P value corresponding to F statistics of one-way ANOVA is higher than 0.05 which indicates that serum iron and zinc level in all the groups are similar without any difference. From Table 6 by comparison of serum iron with anemia P value corresponding to F statistics of one-way ANOVA is lower than 0.01 which strongly indicates that serum iron levels are not same in all the groups of children with or without anemia. Hence on doing post HOC analysis using 'Tukey HSD' test we got significant difference of serum iron between anemic and non-anemic groups, but we didn't get any difference among anemic groups.

Table 7: Comparison of laboratory investigations in relation to type of substances.

		Mud	Paper	Stone	Chalk	'f' statistic	P-value
Iron	N	26	17	12	10	0.4947	0.6873
	Mean	28.7	27	22.4	31.5		
	Sd	18.11	18.73	18.24	20.09		
Zinc	N	18	17	12	11	1.6669	0.1850
	Mean	80.45	76.45	66.10	67.81		
	Sd	21.35	10.11	23.35	20.44		

For Zinc P value corresponding to F statistics of one-way ANOVA is higher than 0.05 which indicates that serum zinc level in all the groups are similar without any difference.

Table 7 showed that the P value corresponding to the 'F' statistic of one-way ANOVA is higher than 0.05 which indicates that serum iron and zinc levels in all the groups are similar without any difference.

DISCUSSION

PICA is the persistent craving for inedible substances which is inappropriate to the developmental level and not a part of clinically sanctioned practice. It is most commonly reported in the children throughout the world. The prevalence of pica varies depending on the definition of pica, characteristics of the population sample and the methods used for data collection.[11]

This a case control study comprising of children belonging to age group 1-5 years who attended pediatric department of SRM medical college hospital and research centre.

This study includes 51 children with pica and 51 children without Pica. Both the groups were comparable with respect to age, sex, average weight and height. Children with severe malnutrition were excluded from the study because malnutrition is associated with significant changes in the plasma level of trace elements.

In the present study the age of the children ranges from 12-60 months. Of which majority of them were in between 12-36 months 36 (70.6%) children in cases and 35 (69.6%) in controls. Regarding gender there was no difference between two groups. Among children with pica male predominance is seen

In the present study 37 (72.5%) children were 12-24 months old at the onset of pica, 38 (74.5%) had pica for 3-12 months of duration, 42 (82.4%) children ingest 2-3 substances and 21 (41.2%) ingest at a frequency of 3-5 times/day. Singhi et al study shows 84% were1-2 years old at the onset of pica, 74% had pica for 3-12 months and 81% ingest inedible substances up to 5 times per week.[12]

In the present study almost 16 items were ingested by children with pica. Soil is the most common type of pica (49% of children) followed by paper (33.3%) and stone (23.5%) whereas least percentage is seen for starch, soap, faeces and others.

In Ravinder and Ritu et al study, clay was the material used by majority of the children and also reported that geophagia is the most common form of pica in people living in poor societies.[13]

In the present study family history of pica is seen in 6 (11.8%) cases when compared to 1 (2%) in control group. This is almost statistically significant (p = 0.050) as the members of the family were exposed to the same environment, nutritional and psychological make ups. In Ravinder and Ritu et al study 44% of them had family history of Pica.[13]

In our study pica is observed more in the children from semi urban area 33(64.7%) than children from rural areas 18 (35.8%). Majority of the mothers i.e 47 (92.2%) are

housewives, 29 (56.9%) belonging to upper lower socio-economic status, 17(33.3%) had educational status up to secondary school as compared to illiterate 15(29.4%), working mothers 4 (7.8%). Residence, mother's occupation, mother's education and socioeconomic status were not statistically significant (p >0.05). It may be because since the study was conducted in semi urban area and in the homogenous population, also people from high socioeconomic status were not studied. According to Elnemeret FM al, study majority of children with pica lives in rural area (79.3%).[14] Also in this study majority of the mothers were illiterate housewives (72.9%), had education status up to higher secondary (57.5%) as compared to illiterate (37.9%) and 93.1% belongs to low socioeconomic status.

Also, in the present study most of the children with pica belongs to nuclear family 30 (58.8%) which is statistically significant (P: 0.017).

Regarding feeding in the present study 29.4% of the children were bottle fed as compared to 13.7% children in control group which is almost significant (p=0.05). Probably bottle feeding is an environmental factor may be responsible for iron deficiency which in turn may cause Pica. This is statistically not significant with Ravinder and Ritu et al study.[13] El nemer FM pica was more common in bottle feed children (70.1%) than breast feed (29.9%) children.[14]

In the present study majority of the children presented with chief complaints of poor appetite (43.1%) followed by pain abdomen and cough (22.5%). In El nemer FM study diarrhea is the major complaint (15.3%) followed by cough (14.9) and abdomen pain (10.3%).[14]

In the present study majority of the children with pica were anemic 42 (82.3%) with mean Hb 9.38±1.55gm/dl when compared with control group children with anemia 16 (31.4%) with mean Hb 11.68±1.20gm/dl. The difference is statistically significant (P <0.001). Gupta N et al, reported the mean Hb in children with pica is 8.4±1.4gm/dl as compared to no pica group with mean Hb 9.4±1.4gm/dl.[15] Acharya et al, showed the mean Hb in children with pica is 9.28±2.25 gm/dl when compared to control group mean of 9.3 ± 2.31 gm/dl.[16]

In the present study 41 (80.4%) children with history of pica showed low serum iron levels with mean iron 31.27±20.68 µg/dl when compared to control group 12 (23.5%) children showed low serum iron with mean iron 66.92±24.31µg/dl. The difference is statistically significant (P<0.001) between two groups. This signifies that there is strong association between pica and low iron.

In the present study 39 (76.5%) children with Pica showed microcytic hypochromic picture when compared to 11 (21.6%) children in control group. The difference is statistically significant. Al-Sawaf et al study reported 91.25% had microcytic hypochromic anemia with drastic

response to iron therapy.[17] Gupta N et al, showed mean serum iron 43.3±10.4µg/dl in children with pica is significantly lower than non-pica group mean iron 51.4±10.7 µg/dl (P<0.001).[15] El nemer FM et al observed 83.9% of the children with pica had low serum iron with mean 54.51±35.60µg/dl.[14]

In the present study 11 (21.6%) children with history of pica had low serum zinc with mean 74.68±19.26 whereas in control group none of them showed low serum zinc with mean 86.29±14.18µg/dl. The difference is statistically significant (P 0.001). All zinc deficiency children were in pica group. This indicates that there is strong association between serum zinc ad pica.

El nemer FM et al reported 89.66% of pica children had significantly low serum zinc levels with mean 45±0.08µg/dl.[14] Gupta N et al, reported mean plasma zinc I children with pica (58.8±13.9 µg/dl) was almost 45% lower than control group mean zinc (104.4±11.8µg/dl).[15]

In the present study only 2 (3.9%) children with history of pica showed low serum calcium as compared to control group where none of them had low serum calcium levels. The difference is statistically insignificant. But the mean calcium in children with pica (8.68±0.54 mg/dl) is significantly low (P-0.014) when compared to control group (8.94±0.51mg/dl). Singhi et al, reported that mean calcium in children with pica is 10±0.2 mg/dl and in control group is 10.2±0.5 mg/dl which was similar and within normal range in both the groups.[12]

In the present study serum iron or zinc did not differ significantly in relation to number of substances ingested or duration of ingestion or frequency of ingestion and in relation to type of substances like soil, stone, paper and chalk (P >0.05 by ANOVA analysis). Singhi et al 200312 and Gupta N et al also reported that serum iron iron or zinc did not differ significantly with frequency of ingestion or number of substances eaten.[15]

In the present study serum iron in relation to anemia in children with pica is significantly lower than pica children without anemia (P-0.0001). Then by using Post HOC test it was observed that there is significant difference in low serum levels of iron between anemic and non-anemic pica children, but no difference is seen among anemic subgroups of pica children.

Similarly, serum zinc levels in pica children with anemia did not differ significantly when compared to non-anemic pica children (P>0.05).

CONCLUSION

Family history of pica, Nuclear family and poor feeding practices like bottle feeding has significant association with pica. Majority of the children had pica at the age of 12-24 months, ingests 2-3 substances at a time for a period of 3-12 months at a frequency of 3-5 times per

day. There was higher prevalence of iron deficiency and zinc deficiency in children with pica. Also, the average levels of iron and zinc was low in children with pica. This confirms that there is definite relationship between pica and low serum iron and zinc levels.

There was no relationship between number of substances eaten or duration of ingestion or frequency of ingestion and different type of substances with serum iron or zinc levels. The difference in serum calcium was not statistically significant.

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