

Comparison of Pica in Breastfeeding versus Artificial Feeding in Children 2 Years of Age or Younger

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Abstract

Background: Pica is the daily compulsive eating of food or nonfood items not part of one's habitual diet or preferences, which is inappropriate to the developmental level. Pica is a distinctive but poorly understood accompaniment of iron deficiency or depletion in some children, although most pica items contain little or no iron. **Objectives:** The objective of the study is to assess and compare pica in breastfed versus artificially fed children aged 2 years or younger in Hilla city, Babylon Province, Iraq. **Materials and Methods:** This is a descriptive hospital based cross-sectional study which was carried out on a convenient sample of 150 children aged 2-year-old or younger who attended pediatric clinics in three hospitals in Babylon Province in the Center of Iraq who accepted to participate in this study. **Results:** The study found that the mean age (month) of children with childhood pica is 14.51 ± 4.13 with the mean birth weight (g) is 2812.83 ± 533.18 , the gender gap in childhood pica is in favor of male children (69.3%). The study found that almost two-thirds of children with pica were breastfed (68.7%) while the other one-third was artificially fed. The majority of children suffering from pica consumed the material clay (43.3%). The mean of hemoglobin (Hb) (g/dl), total serum iron ($\mu\text{g/dl}$), and serum ferritin (ng/ml) and which is 8.44 ± 1.50 , 7.68 ± 2.36 , and 6.36 ± 1.54 , respectively. **Conclusion:** Children with pica had low level of Hb, iron, and ferritin which mimics the hematological picture accompanying iron deficiency anemia. There is a significant mean difference between the type of feeding of children with pica and the birth weight, serum iron, Hb, and serum ferritin. Furthermore, there is a significant association between type of feedings and the following variables: gestational age, onset of pica, birth order, and spacing between births.

Keywords: Anemia, clay, iron, pica

INTRODUCTION

Pica is defined as the compulsive eating of nonfood material persisting for more than 1 month.^[1] The name pica comes from the Latin word for magpie, a bird known for its large and random appetite.^[2] Pica can imply the consumption of a range of substances, geophagy, the consumption of earth, and amylophagy, the consumption of raw starches, are among the most common types of pica.^[3,4]

Pica is the pathological craving for and eating of a nonnutritive item (e.g., clay, coal, paper, ashes, balloons, chalk, metal, grass, crayons, insects, sand, soap, paste, string, plastic, baby powder, paint chips, wallboard, and ice) or food ingredients (flour and raw potatoes).^[2] This may vary by ethnicity, culture, race, or geographic region.^[4] There are several theories to explain pica; one is hunger,^[5] but given that patients usually consume small quantities of nonfood substances between meals, this theory is not fully supported.^[6] The protection theory maintains that pica

is a defensive practice that protects the gastrointestinal tract from absorbing pathogens and chemical substances.^[5] Another theory for pica is micronutrient deficiency, for example, iron, zinc, selenium, and calcium. There have been many studies on the validity of this hypothesis.^[1,5,7] According to this theory, the patients' taste toward the deficient material changes.^[5] Furthermore, it seems that culture plays a major role in some societies.^[8]

The aim of this study was to assess and compare pica in breastfed versus artificially fed children aged 2 years or younger in Hilla city, Babylon Province, Iraq.

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MATERIALS AND METHODS

Study design

This is a cross-sectional study which was conducted at Babylon Maternity and Pediatrics Hospital, Al-Sadik Teaching Hospital and Al Noor Pediatrics Hospital in Al-Hilla-Babylon province, Iraq, between March 1 and August 1, 2018.

Study population

This study included a convenient sample of 150 children aged 2-year-old or younger who attended pediatric clinics in the above-mentioned hospitals who agreed to participate in this study. The statistical calculations were performed using Statistical Package for the Social Sciences version 24 (SPSS, IBM Company, Chicago, USA).

RESULTS

Table 1 shows that the mean age (month) of children with childhood pica in our study is 14.51 ± 4.13 with the mean birth weight (g) is 2812.83 ± 533.18 . The childhood pica tends to be more pronounced in the third or more birth order of the child.

Table 2 shows that half of the parents of children with pica had no source of information about the cause of the problem. About 33.3% of parents were informed by their doctor about the problem. Forcing the child to abstain from pica materials is almost a universal response of parents. When parents discover pica in their children, 34.7% opted to switch the mode of feeding as a mean of tackling the problem. About 60.7% of children have a positive family history of pica in their mothers, and likewise, 57.3% have a positive family history of pica in siblings.

Table 3 shows that clay, soil, stones, and dirt account for a total of (69.3%) of the types of material in childhood pica. One in ten children ingested soap and shampoo (9.3%). The remaining 20% of children ingested a wide range of materials including clothes, paper, paint chips, wood, tissues, hair, and chalk among others.

Table 4 shows that a majority of mothers of children with childhood pica were aged 18–35 years (82.0%), living mostly in urban areas (59.3%). Two out of three mothers have a secondary level of education, and one of four was employed. 20.7% reported family disorganization.

Table 5 shows the mean of total serum iron ($\mu\text{g/dl}$), serum ferritin (ng/ml), and hemoglobin (Hb) (g/dl) which is 7.68 ± 2.36 , 6.36 ± 1.54 , and 8.44 ± 1.50 , respectively.

Table 6 shows that *t*-test was conducted to determine if differences existed between the mean of serum iron, Hb and serum ferritin with the type of feeding of children (breastfeeding or artificial feeding). There is a significant mean difference in all circumstances ($P \leq 0.05$).

Table 7 shows that *t*-test was conducted to determine if differences existed between the mean of age, birth weight, and gestational age with the type of feeding of children (breastfeeding or artificial feeding). There is a significant

Table 1: Distribution of child with pica according to sociodemographic factors

	mean \pm standard deviation
Age (month)	14.51 \pm 4.13 (6-24)
Birth weight (g)	2812.83 \pm 533.18 (1000-4100)
Gestational age (week)	38.25 \pm 1.73 (33-42)
Birth order, n (%)	
First	17 (11.3)
Second	41 (27.3)
Third or more	92 (61.4)
Total	150 (100.0)

Table 2: Distribution of variables regarding children with pica

Variable	n (%)
What is the source of information about pica?	
No source	76 (50.7)
Doctor	50 (33.3)
Social media	17 (11.3)
Media (TV, radio, newspaper)	7 (4.7)
Total	150 (100.0)
Has the respondent attempted to tackle the problem by forcing the child to abstain?	
Yes	114 (76.0)
No	36 (24.0)
Total	150 (100.0)
How did the respondent discover the problem?	
Mother	100 (66.6)
Grandparents	37 (24.7)
Babysitter	7 (4.7)
Other	6 (4.0)
Total	150 (100.0)
Did pica onset influence the respondent to switch from one mode of feeding to another?	
Yes	52 (34.7)
No	98 (65.3)
Total	150 (100.0)
Family history of pica in mother	
Yes	91 (60.7)
No	59 (39.3)
Total	150 (100.0)
Family history of pica among siblings	
Yes	86 (57.3)
No	64 (42.7)
Total	150 (100.0)

mean difference in all circumstances ($P = 0.017, 0.019, \text{ and } 0.043$, respectively).

Table 8 shows that Chi-square test was conducted to show the association between onset of pica in children, gender, birth order, family income, and spacing between births with the type of feeding of children (breastfeeding or artificial feeding).

Table 3: Distribution of the types of material eaten by the child with pica

Material	n (%)
Clay	65 (43.3)
Soil	16 (10.7)
Clothes	7 (4.7)
Stones	15 (10.0)
Dirt	8 (5.3)
Soap and shampoo	14 (9.3)
Hair	1 (0.7)
Paint chips	5 (3.3)
Paper	4 (2.8)
Tissues	8 (5.3)
Chalk	5 (3.3)
Wood	2 (1.3)
Total	150 (100.0)

Table 4: Distribution of maternal sociodemographic factors

Variable	n (%)
Maternal age (year)	
<18	13 (8.7)
18-35	123 (82.0)
>35	14 (9.3)
Total	150 (100.0)
Residence	
Urban	89 (59.3)
Rural	61 (40.7)
Total	150 (100.0)
Maternal education	
Illiterate	28 (18.7)
Primary	44 (29.3)
Secondary	58 (38.7)
Higher education	20 (13.3)
Total	150 (100.0)
Maternal employment	
Employed	40 (26.7)
House wife	110 (73.3)
Total	150 (100.0)
Ethnicity	
Arab (local native)	139 (92.7)
None Arab (IDP)*	11 (7.3)
Total	150 (100.0)
Income (IQD)	
<300,000	49 (32.7)
300,000-1,000,000	84 (56.0)
>1,000,000	17 (11.3)
Total	150 (100.0)
Family disorganization	
Yes	31 (20.7)
No	119 (79.3)
Total	150 (100.0)
Chronic medical illnesses**	
Present	44 (29.3)
Absent	106 (70.7)
Total	150 (100.0)

*, **, Chi-squared and Fishers' exact tests were performed for statistical analyses. IQD: Iraqi dinars

There is a significant association between onset of pica, birth order, and spacing between births with the type of feeding of children (breastfeeding or artificial feeding) $P = 0.035$, <0.001 , 0.008 , respectively.

Regarding the distribution of children by gender, results found that the gender gap in childhood pica is in favor of male children (69.3%) while only 30.7% were of female children.

Regarding the distribution of children by type of feeding by gender, results found that almost two-thirds of children with pica were breastfed (68.7%) while the other one-third (31.3%) was artificially fed.

DISCUSSION

This study dealt with child sociodemographic factors and found that the age of children with pica ranged from (6 to 24 months).

In a study done in Egypt,^[9] it found that the age of children suffering from pica ranged from 20 to 72 months. Our study found that the majority of childhood pica starts at the 1st year of life or older (65.3%), and in <1 year of age, the percentage is 34.7; birth weight ranged from 1000 to 4100, with the mean age in (months) is 14.51 ± 4.13 . The mean birth weight in (g) is 2812.83 ± 533.18 . A similar study done in Egypt found that the mean age (months) is 39.33 ± 12.07 .

We observed that there is a significant mean difference between the mean of (age and birth weight) and type of feeding of children ($P = 0.017$ and 0.043 , respectively).

As far as gender is concerned, 69.3% of patients were males and 30.7% of patients were females. A study done in Sudan^[10] found that 58.4% of patients were male and 41.6% were female, while a study in Iran^[11] showed that 66.5% of patients were females and 33.5% were males. A third study in Egypt^[9] revealed that 63.2% of patients were males and 36.8% were females with definite male predominance. These results, regarding the gender and age are almost in agreement with other studies.^[12,13] However, the findings are in disagreement with a study in Iran where they did not find a significant association between gender and pica.^[14]

Regarding feeding, this study showed that almost two-thirds of children with pica were breastfed (68.7%) while the other one-third (31.3%) were artificially fed.

In comparison, a study in medical college Jammu^[15] found that pica was seen more in bottle-fed children than breastfed children and this is in agreement with a study done in Egypt^[9] which found that pica was more in bottle-fed children (70.1%) as compared to breastfed children (29.9%).^[13]

There is a significant association between onset of pica with the type of feeding of children (breastfeeding or artificial feeding) $P = 0.035$. The study also took into consideration maternal socio-demographic factors and showed that the maternal age which is <18 years accounts for 8.7%, maternal age between 18 and 35 years is 82% and more than 35 years is 9.3%.

Regarding residence of mothers of children with pica, they tend to live mostly in urban areas (59.3%) more than mothers of children living in rural areas (40.7%). While in another study, the majority of children were living in rural areas (79.3%) rather than children living in the urban area (20.7%).^[9]

The majority of mothers had education status up to secondary school (38.7%), higher education (13.3%), primary (29.3%), and illiterate (18.7%). In an international study done in medical college of Jammu^[15] where they found that 82% of parents had an education status up to secondary school level while other study showed the majority of mothers had an educational status up to secondary school level (57.5%) and illiterate (37.9%).^[9]

Regarding mother's occupation, the pica was observed more in children of homemakers (73.3%) than working mothers (26.7%) and these results are in agreement with another study in Egypt which showed that pica was observed more in children of homemakers (72.9%) as compared to working mothers (27.1%).^[9] Our results are not in agreement with a study done in Adval Pediatric Clinic^[15] where the pica was observed more in children of working mothers.

In this study, regarding the socioeconomic status of families of children with pica, we found that (56%) of families have monthly income ranging from 601.000 to 800.000 IQD, 32.7% of families their monthly income was 400.000-600.000

and 11.3% of families their monthly income was from 801.000-1000.000 however, other studies have found that pica is more common among those with low socioeconomic status.^[16] There is no significant association between monthly income and type of feeding in children with pica.

More than two-thirds (66.6%) of childhood pica were discovered by mothers, 24.7% by grandparents, 4.7% by babysitters, and 4% by others while Ravinder and Ritu^[13] where that 32% of childhood pica was discovered by mothers.

Regarding family history of pica among siblings, this was positive in 57.3% and family history of pica in mothers was positive in 60.7% of children while in a study done in Adval pediatric clinic^[15] where they found family history was positive in 44%, in accordance with other studies.

In our study, clay was the material used by majority of children suffering from pica (43.3% of children), soil (10.7%), stone (10.0%), soap and shampoo both (9.3%), and the least percentage is for stool, ice, and hair with no significant difference between the studied groups. This is in agreement with studies in Sudan^[10] which revealed that the most commonly consumed items were clay (53.1%), ice (21.4%), and charcoal (2.0%). This is similar to a study done in Medical College Jammu where the results show clay was the material used by 53% of children.

In a study done in Iran,^[11] they found that the most common type of pica was soil (62.3% of the cases) followed by paper (31.2% of the cases). As compared to a report from Madagascar with 53% geophagy and 85% amylophagy. In the observed population, pica was not regarded as stigmatized culture, rather a divergent behavior.^[17]

Anemia is a common problem in children associated with increased mortality, morbidity, and impairment mental development.^[18]

Table 5: Mean and standard deviation of serum iron, ferritin and hemoglobin

Variable	Mean±SD	Range
Total serum iron (µg/dl)	7.68±2.36	4-22
Serum ferritin (ng/ml)	6.36±1.54	3.7-11.0
Hemoglobin (g/dl)	8.44±1.50	6-11.9

SD: Standard deviation

Table 6: Differences between type of feeding of children and the mean of serum iron, hemoglobin and serum ferritin

Study variable	Study group	n	Mean±SD	t	P
Total serum iron (µg/dl)	Breast feeding	103	7.1±2.26	-4.746	<0.001*
	Artificial feeding	47	8.95±2.08		
Hemoglobin (g/dl)	Breast feeding	103	7.84±1.32	-8.948	<0.001*
	Artificial feeding	47	9.75±0.92		
Serum ferritin (ng/ml)	Breast feeding	103	6.15±1.3	-2.529	0.03*
	Artificial feeding	47	6.83±1.89		

*P≤0.05 was significant. SD: Standard deviation

Table 7: Differences between the mean of age, birth weight, and gestational age with the type of feeding of children

Study variable	Study group	n	Mean±SD	t	P
Age (months)	Breast feeding	103	13.97±3.96	-2.416	0.017*
	Artificial feeding	47	15.7±4.29		
Birth weight (g)	Breast feeding	103	2881.31±450.1	2.364	0.019*
	Artificial feeding	47	2662.77±490.39		
Gestational age (weeks)	Breast feeding	103	38.44±1.73	2.046	0.043*
	Artificial feeding	47	37.82±1.67		

*P≤0.05 was significant. SD: Standard deviation

Table 8: Association between sociodemographic factors and type of feeding of children

Study variables	Type of feeding		χ^2	P
	Breast feeding (%)	Artificial feeding (%)		
Onset of pica				
<1 year of age	30 (29.1)	22 (46.8)	4.455	0.035*
1 year or more	73 (70.9)	25 (53.2)		
Total	103 (100.0)	47 (100.0)		
Gender				
Male	70 (68.0)	34 (72.3)	0.291	0.59
Female	33 (32.0)	13 (27.7)		
Total	103 (100.0)	47 (100.0)		
Birth order				
First	8 (7.8)	9 (19.1)	28.897	<0.001*
Second	17 (16.5)	24 (51.1)		
Third or more	78 (75.7)	14 (29.8)		
Total	103 (100.0)	47 (100.0)		
Monthly income (IQD)*				
400.000-600.000	29 (28.2)	20 (42.6)	3.11	0.211
601.000-800.000	62 (60.2)	22 (46.8)		
801.000-1000.000	12 (11.7)	5 (10.6)		
Total	103 (100.0)	47 (100.0)		
Spacing between births (month)				
<12	57 (55.3)	12 (25.5)	11.875	0.008*
12-<18	20 (19.4)	17 (36.2)		
18-23	17 (16.6)	11 (23.4)		
>23	9 (8.7)	7 (14.9)		
Total	103 (100.0)	47 (100.0)		

* $P \leq 0.05$ was significant, IQD: Iraqi dinars

Iron deficiency anemia is one of the most common diseases worldwide. Pica has been reported to be associated with severe iron deficiency anemia in up to half of patients; however, it is unclear whether pica causes or is the consequence of iron deficiency anemia.^[19]

Several hypotheses exist about why iron deficiency causes pica, including physiological mechanisms; however, there is no single agreed-upon explanation.^[19]

When associated with iron deficiency, it is believed to be a symptom of the deficiency rather than its cause.^[20,21] Occasionally, pica practices cause other nutritional deficiencies such as hypokalemia.^[22,23]

In the present study, the mean Hb is (8.44 g/dl \pm standard deviation [SD] 1.50) and ranging from (6 to 11.9), mean total serum iron is (7.68 μ g/dl \pm SD 2.36) ranging from (4 to 22) and mean serum ferritin is (6.36 ng/dl \pm SD 1.54), ranging from (3.7 to 11.0) as compared to study of Ritu K Gupta where the results were the initial Hb levels were <8 g/dl in 34.5% and 11 g/dl or greater in 20% of pica children. In Sudan iron deficiency, anemia was seen in 50% of children who had pica. The mean Hb was significantly lower in the study, at the same time, they had a significantly higher reticulocyte count.

This is similar to the report from Belgium.^[24] Miao *et al.* reported in their meta-analysis a significant association of pica with low Hb and low hematocrit.^[25] However, results of El-Nemer *et al.*^[9]

showed that the mean Hb was (9.7 g/dl \pm SD 1.5), ranging from (6.70 to 12.80). Regarding serum iron, mean iron level 54.51 μ g/dl, ranging from (35.60 to 139.10).

Mean level of serum ferritin 14.24 \pm 16.13 ng/ml and ranging from 4.20 to 55.10. This results are in agreement with Singhi *et al.*^[26] who found that mean Hb, iron levels were significantly lower in children suffering from pica with Hb level 8.5 \pm 1.3 g/dl (range 6.5–11.5), iron level 42.7 \pm 9.2 μ g/dl (range 30–67).^[26] Thus, pica results in malabsorption of iron from the diet with the resultant strong association between iron deficiency and pica. Furthermore, in agreement with Al-Sawaf as the hemoglobin level was 9.5–11.5 g/dl in 34.38% and it was 6.5–9 g/dl in the remaining 65.62%.^[12]

There is a significant mean difference between the mean of serum iron, Hb and serum ferritin with the type of feeding of children (breastfed or artificially fed) ($P < 0.05$). Meanwhile, other studies failed to find any association between pica and anemia and/or iron deficiency ($P > 0.05$).

These findings differ from those of some other studies.^[15,9,27,28] At least two double-blind controlled studies did not find any relationship between iron therapy and pica behavior.^[25] This is probably because pica is more a cultural behavior than a result of iron deficiency. On the other hand, some other studies have shown that pica was common in patients with sickle cell anemia; these patients usually have high iron levels.^[29,30]

CONCLUSION

Pica is not an uncommon problem among children, and it is frequently associated with iron deficiency anemia. Prolonged unexplained iron deficiency anemia should prompt clinicians to remember and inquire about pica. The prevalence of pica is higher in children 2 years of age and under. Clay was the material consumed by the majority of children suffering from pica. Children with pica had low level of Hb, iron, and ferritin. Which mimics the hematological picture accompanying iron deficiency anemia. There is a significant mean difference between the type of feeding of children with pica and the birth weight, serum iron, Hb, and serum ferritin. Furthermore, there is a significant association between type of feedings and the following variables: gestational age, onset of pica, birth order, and spacing between births.

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Conflicts of interest

There are no conflicts of interest.

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