

GEOPHAGIA (DIRT-EATING) AS A CAUSE OF ANEMIA IN CHILDREN*

A Report on Sixty Cases

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Geophagia (dirt-eating) is the most commonly recognized form of pica. It has been known since ancient times, and is well authenticated in the literature of many countries and cultures. Dirt-eating is prevalent in a number of ethnic groups in many different countries^{4,6} and is traditionally practiced by certain savage tribes.⁷ Some women eat dirt during pregnancy.⁸ Most children eat dirt, and some actually acquire a dirt-eating habit.⁹⁻¹⁷ It is with this group of children that this article is concerned.

The interest of the author in this study originated, first, from the knowledge of the work of Tayanç,¹⁵ and second, from the frequency with which dirt in the colon was disclosed in routine x-rays of children in the Hospital of Corpus Christi, Texas. It soon became evident that there was more than a casual relationship between severe dirt-eating and anemia.

During the past four years, we have studied 60 patients who were dirt-eaters. Five of them were previously reported.¹⁶ The majority of the cases were observed during a period of over two years. During the past two years, at least an equal number of cases have been diagnosed and treated, but not as completely studied or followed for as long a period as the cases herein reported. The purpose of this paper is to present evidence that dirt-eating may cause anemia in children.

Review of the Literature

One of the first interesting reports on geophagia in children was presented 1884 by Dukes.¹⁸ He described a five year old child who had been eating dirt for two years. Vomiting was present and intestinal parasites were seen in the stool. "She ate dirt to relieve gnawing pains in her stomach, and when unable to obtain dirt, she would eat mortar from the walls."

* This study was carried out at the Driscoll Foundation Children's Hospital, Corpus Christi, Texas.

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In 1895 Thomson¹⁷ described dirt-eating in children and noted that dirt-eating stopped spontaneously at about three years of age.

In 1910 Kültz and Zeller⁶ stated that geophagia resulted from a physiologic craving for certain nutritional salts. Dock and Bass,¹² Gelfand,¹⁹ Stetson,²⁰ Beaver and his co-workers,²¹ and Mercer and his co-workers²² associated the presence of intestinal parasites with dirt-eating. Gelfand and Stetson, however, found no direct relation between geophagia and the occurrence of intestinal parasitism.

In 1923 Carrion¹ stated that "children ate dirt to relieve hunger spasms and to neutralize gastric juice," whereas Gelfand¹⁹ felt that children ate dirt to acquire roughage.

Chapard² in 1926 observed that along the Amazon River, "mothers gave clay to their children to stop them from crying and that many of these children died from that abnormal diet."

In 1929 Blanchard²³ reported that children who ate dirt often developed extreme anemia, edema, ascites and cardiac difficulties and that they died unless given intensive treatment.

In 1934 Booth⁹ reported a case of tetanus caused by dirt-eating. In 1936 D Toni¹⁰ reported very interesting observations on geophagia and its relation to a fibrous congestive type of Banti's splenomegalic anemia.

Tayanç,¹⁵ in 1942 and 1943, described hypochromic anemia associated with dirt-eating, and reported 15 cases ranging from 1 1/2 to 18 years of age.

The extent to which dirt-eating occurs in Negro children was emphasized in 1942 by Dickens and Ford,¹¹ who found that 25% of children in the third grade of a Mississippi school had eaten dirt in the 10 to 16 days preceding their examination.

Perlingiero and György,²⁴ and Zuelzer and Apt,²⁵ described infestation with larval ascariasis associated with geophagia. Dent and Carrera²⁶ pointed out that visceral larva migrans usually occurs in children at an age when they are most apt to swallow dirt. Van der Sar and Waszink²⁷ in 1952 reported a case of abdominal pain and obstipation in a five year old Negro boy following the eating of stones. These authors²⁷ and others^{28,31} also discussed the psychosomatic aspect of dirt-eating in children.

Morini and Menozzi¹⁴ in 1954 reported 12 cases of dirt-eaters, ranging from 21 months to 35 years of age, with Banti's syndrome and anemia.

Patient Material

60 cases were observed. The 31 females and 29 males ranged in age from 11 1/2 months to 4 10/12 years. 34 patients were under 2 years of age, and 23 were between 2 and 3 (table 1).

The child's usual play area was the yard or the field of a farm, with little or no supervision.

Some patients were brought to the clinic with dirt-eating as the main complaint. In others, a history of dirt-eating was obtained. A number of patients had been examined in the clinic previously for complaints unrelated to dirt-eating (table 1).

The initial complaints in these patients included the following: dirt-eating (58 cases), irritability (39 cases), constipation (39 cases), weakness (28 cases), vomiting (20 cases), abdominal pain (18 cases), poor weight gain or loss of weight (16 cases), low grade fever (14 cases), loss of appetite (12 cases) and diarrhea (5 cases).

All cases showed a pallor of the skin and mucous membranes. The more severe cases showed poor tissue turgor with a doughy thickening of the subcutaneous tissues. The body weight was within normal limits for age and height in 51 cases. Retarded physical development was present in 51 cases. 33 patients had conspicuous protuberance of the abdomen. Splenomegaly was present in 19 cases, and 3 also had hepatomegaly. Perioral impetigo-like lesions and stomatitis were seen in 9 cases. Hemic murmurs were heard in 10 cases. One patient had a suppurative cervical lymphadenitis from which *Staphylococcus citreus* was cultured. There were no other important physical findings.

With the exception of two cases, a clear-cut history of dirt-eating was obtained during the first examination. In the two cases, anemia and x-ray findings of dirt in the colon led to a diagnosis of dirt-eating which was later confirmed by the parents' observation.

80 per cent of the patients started dirt-eating between the ages of 11 and 14 months. The duration of dirt-eating before being observed in this study was from 2 to 14 months (table 1). The relationship of dirt-eating to the walking age is shown in table I.

Methods

Laboratory data on each case included complete blood counts, urinalysis, tuberculin test, VDRL, roentgenograms of the chest and abdomen, gastric analyses, and at least three examinations of the stool for ova and parasites, for gross dirt and for pH value.

TABLE I.

SUMMARY OF THE FINDINGS IN DIRT-EATING CHILDREN

Case No.	Anemia			Started to walk at age (Mos.)	Started to eat dirt at age (Mos.)	Hemoglobin Values Before Dirt-eating			Duration of Therapy (Wk.) with Cobalt Chloride 40 Mg./Da. and Ferrous Sulfate 75 Mg. / Da.*	After Therapy	
	Age at Diagnosis (Mos.)	Hemoglobin (Gm./100 cc)	R.B.C.(M./mm ³)			Age (Mos.)	Hemoglobin (Gm. / 100 cc)	Hemoglobin (Gm./ 100 cc)		R.B.C.(M/mm ³)	
1	48	10.0	4.10	15	16	—	—	12		11.5	5.17
2	36	8.0	3.28	13	14	—	—	9		13.0	4.10
3	16	9.0	3.90	12	12	—	—	11		11.5	5.15
4	24	6.5	4.36	13	13	—	—	14		11.0	4.60
5	18	8.5	3.60	11	12	—	—	11		12.0	4.90
6	26	7.5	4.65	11	12	10	11.5	10		12.0	5.15
7	34	7.0	3.38	12	16	—	—	8		11.5	4.62
8	28	7.0	3.60	10	11	—	—	9		12.0	4.74
9	14	8.0	4.40	11	11	—	—	7		11.5	4.65
10	24	8.0	4.61	17	20	6	12.5	6		11.5	4.95
11	18	7.0	3.97	13	13	9	11.0	9		11.0	4.86
12	22	8.5	3.60	10	11	7	11.5	6		12.5	4.98
13	16	9.0	3.90	13	13	—	—	11		13.5	5.15
14	36	8.0	3.28	18	18	13	12.0	9*		13.0	4.10
15	48	9.0	4.10	15	15	9	12.5	12*		12.5	5.17
16	17	7.0	4.11	11	12	—	—	9		11.5	5.25
17	17	6.25	4.09	12	12	—	—	9		11.0	4.66
18	36	7.0	3.90	20	20	—	—	8*		12.0	5.12
19	17	7.0	4.48	11	11	5	13.0	8		11.0	5.06
20	24	7.5	3.28	13	14	11	10.5	7		12.0	4.26
21	21	7.0	4.00	15	15	—	—	10		11.0	4.25
22	21	7.0	4.20	10	11	3	11.0	9*		11.3	5.65
23	30	7.5	3.60	12	12	10	11.0	9*		11.25	4.46
24	35	7.5	3.75	16	17	12	10.5	8*		11.6	4.02
25	12	6.5	3.24	11	11	10	11.0	8		11.5	4.40
26	16	6.75	3.90	13	13	—	—	10		12.5	4.10
27	17	5.75	3.73	13	13	11	14.0	12		11.0	4.36
28	18	4.75	2.92	12	13	—	—	13		11.0	4.20
29	13	5.0	3.14	11	11	—	—	8		11.0	4.54
30	24	7.5	4.10	11	12	—	—	7		11.5	4.80
31	28	6.5	3.66	12	12	—	—	11		12.25	4.92
32	23	5.5	3.60	13	13	—	—	8		11.25	4.80

TABLE I. Continued

Case No.	Anemia			Hemoglobin Values Before Dirt-eating				Duration of Therapy (Wk.) with Cobalt Chloride 40 Mg./Da. and Ferrous Sulfate 75 Mg./Da.*	After Therapy	
	Age at Diagnosis (Mos.)	Hemoglobin (Gm./100 cc)	R.B.C.(M/mm ³)	Started to walk at age (Mos.)	Started to eat Dirt at Age (Mos.)	Age (Mos.)	Hemoglobin (Gm./100 cc.)		Hemoglobin (Gm./100 cc)	R.B.C.(M/mm ³)
33	24	5.75	3.20	12	18	—	—	9	11.0	4.90
34	22	9.0	4.10	11	11	7	13.0	6	12.75	4.94
35	24	6.5	3.80	12	12	—	—	8	11.0	4.46
36	15	6.25	3.45	13	13	9	10.5	9	11.75	4.80
37	33	6.5	3.82	12	14	—	—	11*	11.5	4.96
38	20	5.5	3.00	11	11	—	—	12	12.0	4.85
39	32	7.5	4.10	13	22	12	13.0	8*	11.0	4.96
40	14	8.5	4.28	11	11	9	12.5	6	11.0	4.24
41	15	4.5	2.07	12	13	7	11.0	12	11.0	4.34
42	18	6.0	3.90	11	11	—	—	10	11.25	4.41
43	16	7.5	3.68	11	11	—	—	8	11.0	4.10
44	15	4.0	2.82	12	12	8	10.0	9	11.0	4.26
45	26	7.0	3.91	10	11	5	11.0	10	11.5	4.88
46	11	8.0	4.11	10	10	10	12.0	7	12.0	4.96
47	26	6.5	3.14	12	12	—	—	12	11.0	4.26
48	18	4.25	2.69	10	10	—	—	6	10.75	3.90
49	58	6.5	3.94	13	13	—	—	10*	11.0	4.41
50	21	7.5	4.02	11	12	11	11.0	8	11.0	4.42
51	18	5.25	3.10	10	11	—	—	12	11.25	4.66
52	24	6.25	3.62	13	13	—	—	10	11.5	4.65
53	20	7.0	3.68	11	11	5	10.5	10	11.0	4.16
54	24	4.5	2.28	13	20	9	11.0	12	11.0	4.32
55	23	5.5	2.86	11	12	—	—	12	10.50	4.12
56	20	6.5	3.68	13	14	—	—	10	11.0	4.45
57	15	7.0	4.00	11	11	—	—	8	11.5	4.82
58	17	5.75	2.92	12	12	—	—	12	10.5	4.12
59	23	5.0	2.86	13	13	7	11.0	13	10.5	4.12
60	24	7.5	3.69	12	12	11	11.0	10	11.5	4.24

* Elixir Roncovite (Lloyd Brothers, Inc.): each teaspoon (5 c c) contains 15 mg. of cobalt chloride and 250 mg. of ferrous sulfate.

The free and total gastric acidities were determined before and after treatment on all patients.

In 10 patients the following additional studies were performed: thymol turbidity, cholesterol protein-bound iodine and radio-iodine uptake.

Blood calcium, inorganic phosphorus, alkaline phosphatase determinations and bone marrow examinations were performed on 5 cases.

The radiologic method of identifying geophagia has recently been described by Clayton and Goodman,³² and was used routinely in this study.¹⁶

Samples of dirt, brought in by parents from places where the children were seen to eat dirt, differed widely in appearance, ranging from black to red. The dirt was usually eaten in the dry state and contained small stones, sand, pieces of metal, roots and leaves.

Laboratory Findings

Red blood cell counts, hematocrits, blood indices, reticulocytes and platelets were consistently low or decreased to the lower limits of normal. The hemoglobin values were always low (table 1). White blood cell counts were at a high normal value with an essentially normal differential count. Sedimentation rate was normal (3 to 13 mm.) in 51 cases, and slightly elevated (15 to 22 mm.) in 9. C-reactive protein was negative in 57 cases, and was 1 plus in 2, 2 plus in 1 case. VDRL was negative in all cases.

Blood calcium, inorganic phosphorus, and alkaline phosphatase were found to be within normal limits in 5 cases, and bone marrow examination in these cases showed moderate normoblastic hyperplasia.

Liver function tests were normal even though the appearance of the sclerae suggested jaundice in 5 cases.

Thyroid function was found to be normal in 10 cases before and after the treatment of the anemia. Neither clinical experience nor laboratory findings in these patients suggested any decrease in thyroid function from cobalt chloride administration.

Tuberculin patch (Volmer) test was positive in 3 cases. There was no clinical or x-ray evidence of active tuberculosis in these patients.

Gastric analysis showed no free HCl in the fasting specimens, nor in specimens following the test meal, in all 60 cases.

Gross examination of the stools showed the presence of dirt in all cases. The pH of the feces was neutral or alkaline before therapy and neutral or slightly acid after therapy.

In 47 of the 60 cases, x-ray examination of the abdomen showed amorphous densities and opaque shadows within the colon which are characteristic of geophagia.³³

Treatment

57 cases were treated initially with cobalt and iron.* Patients received the cobalt-iron preparation orally as a liquid, in either drops or elixir form. The daily dosage provided 40 mg. of cobalt chloride with 75 mg. of ferrous sulfate in 51 cases, and 15 mg. cobalt chloride with 250 mg. ferrous sulfate in 9 cases for from 6 to 14 weeks. Only 1 case (Case 55) was transfused, before the cobalt-iron therapy was started. In 2 cases (Cases 6 and 12) the effect of treatment with 375 mg. ferrous sulfate a day, without added cobalt, was observed for a period of 8 weeks.**

One case (Case 31) was hospitalized and observed for a period of 8 weeks with no hematinic therapy.

The results in these cases tend to confirm our observations that cobalt-iron therapy is superior to treatment with iron alone.

The findings in the case which received no hematinic and who had an increase in hemoglobin from 5.5 to 6.5 grams in two months, support the observation that this condition is self-limited, and that when severe dirt eating stops there is spontaneous improvement in the anemia.

Illustrative Case Report

G. M., an eighteen month old white female, was admitted to the Hospital with the chief complaints of irritability, weakness, marked pallor of the skin, and constipation of six months' duration.

She had been healthy and well from birth until 12 months of age, at which time she started to walk alone. Soon after she started to walk, her mother noticed that the child "ate dirt like candy" from time to time while she was playing in the back yard by herself or with her siblings.

* The cobalt-iron preparations used in this study were supplied as Roncovite, by Lloyd Brothers, Inc., Cincinnati, Ohio. Roncovite Drops: each 0.6 cc contains 40 mg. of cobalt chloride and 75 mg. of ferrous sulfate. Elixir Roncovite: each teaspoonful (5 cc) contains 15 mg. of cobalt chloride and 250 mg. of ferrous sulfate.

** The ferrous sulfate preparation used in this study was supplied as Fer-In-Sol, by Mead Johnson & Co., Evansville, Indiana. Fer-In-Sol: each 1 cc supplies 125 mg. of ferrous sulfate.

Her sister (3 years old), and brother (6 years old) were also dirt-eaters who had spontaneously stopped eating dirt at 2 1/2 and 3 years respectively. Their blood counts at the time of the patient's admission showed hemoglobin concentrations of 9.5 and 9.75 gm. per hundred cubic centimeters.

The father, 30 years old, was a laborer. The family's financial situation was poor. The patient was the result of a 28 year old mother's seventh normal pregnancy, and the delivery was spontaneous following a three hour labor. The birth weight was 3,900 gm. The patient was fed on evaporated milk formula, and the neonatal period was uneventful. Cereal and orange juice were started at 2 months of age, and vegetables and meats at 6 months; no vitamin or iron preparations were given. She had been in good health, and her appetite was good until the present illness. She cut her first tooth at 5 months of age. She sat alone at 7 months of age, and walked alone at 12 months. At about 13 months, the mother noticed irritability, followed by weakness, generalized pallor and constipation, which symptoms gradually increased in severity for six months, and even more so during the three months preceding admission after the eighth sibling was born.

The patient was not under adult supervision during most of the day, and had an unlimited opportunity to eat dirt. Her mother stated that during the first two months, after she noticed this habit, she did not worry about the patient.

The physical examination on admission showed a fairly well-nourished and well-developed 18 month old Latin - American girl, who appeared very pale and irritable. She showed a generalized waxy pallor and had a markedly protuberant abdomen. Fecal masses were palpable on abdominal examination and the spleen was enlarged about 3 cm. below the left costal margin. The physical examination was otherwise normal.

Laboratory findings: On admission the hemoglobin concentration was 4.75 gm. per hundred cubic centimeters with 3,860,000 erythrocytes and 12,900 leucocytes per cubic millimeter. There were 51 segmented neutrophils, 3 stabs, 39 lymphocytes, and 7 monocytes. The hematocrit was 21 per cent. The M.C.V. was 69 cubic microns, M.C.H. 20 micrograms, and M.C. H. C. 16 per cent. Reticulocytes were 0.3 per cent, platelets 270,000 per cubic millimeter. The sedimentation rate was normal and C-reactive protein was negative. Urinalysis was negative. Additional studies that were negative or normal included: x-ray of the chest, serological tests for syphilis, thymol turbidity, cephalin flocculation, cholesterol, serum calcium,

phosphorus (inorganic), total protein, tuberculin patch test, histoplasmin, and coccidioidin tests.

Three stool examinations were negative for ova and parasites, but grossly they showed the presence of dirt. The pH of each of the three stools before treatment was 9. Gastric analysis revealed no free hydrochloric acid in the fasting specimen (F), nor in specimens I, II, and III following the test meal. After the subcutaneous administration of 0.25 mg. of histamine acid phosphate, specimen IV showed 32 degrees, V showed 40 degrees, and VI showed 47 degrees of free hydrochloric acid. The PBI was 5.28 per cent, and I¹³¹ uptake was 24.0 per cent. The chest x-ray was negative. x-ray of the abdomen showed opaque material in the colon which was consistent with geophagia.

The patient was put on a regular diet, and 0.6 cc of a solution containing Roncovite (40 mg. cobalt chloride and 75 mg. ferrous sulfate) was given daily in fruit juice. Constipation was relieved by the administration of 1 cc. 5% dioctyl sodium sulfosuccinate (Doxinate) for five days. Dirt was present in the stool specimens, on the fourth and fifth days, and was absent after the sixth day. The pH of these stools was 8, 7 and 5. Roentgenologic examination four days after admission showed no evidence of dirt in the colon.

On the ninth hospital day the patient's gastric fluid examination showed no free HCl in the fasting specimen (F). Following the test meal specimen I was negative, specimen II showed 23 degrees and III 32 degrees of free hydrochloric acid, which was completely normal.

The hemogram showed rapid improvement during the first week. On the eighth day the hemoglobin was 6.75 gm. per hundred cubic centimeters with 4,620,000 erythrocytes. After six weeks of treatment with the cobalt-iron mixture the hemoglobin concentration increased to 11.5 gm. with 4,440,000 erythrocytes. The hematocrit was 42 per cent. The M.C.V. was 94 cubic microns, M.C.H. 25 micrograms, and M.C.H.C. 26 per cent. Reticulocytes were 1.5 per cent, platelets 362,000 per cubic millimeter.

After six weeks' treatment of anemia with cobalt-iron mixture the PBI was 4.4 micrograms per cent, and the I¹³¹ uptake was 15 per cent.

Her body weight was 9.43 Kg. on admission, and 11.20 Kg. six weeks later. When she was returned to the clinic one and two months later, her hemograms were relatively unchanged, and she had not eaten dirt since discharge from the hospital. During the next eighteen months she was observed in the clinic at three month intervals and was found in good health with normal blood counts at each clinic visit.

Discussion

Geophagia should be considered in the differential diagnosis of hypochromic anemia occurring in children between the ages of 1 to 5 years.

An infant is apt to put anything into his mouth.¹ Dirt-eating is seldom practical until after the age of 11 months, when the child is walking and attains poorly supervised access to the yard. The natural tendency for pica usually ceases spontaneously by the age of two or three years. There are several conditions which are prevalent in our clinic patients as a whole, that may have contributed to the dirt-eating of the patients in this study.

A large number of siblings in the family prohibits proper attention to each one. Thirty-four (56%) of the cases came from homes where there were 4 or more siblings. The living conditions were usually poor and crowded, and the mother often too busy to give proper care to the children.

60 per cent of the mothers in this series had no primary school education, and most of these could not speak English. 5 of the mothers were 15 to 18 years of age and already had one or two babies.

Many of our patients come from broken homes. 10 of these patients lived with relatives, or in poor foster homes where they possibly did not receive proper care and attention.

Most patients in the clinic in which these cases were found are not breast fed; probably the percentage of breast feeding in the cases reported is neither greater nor less than in the general clinic group. However, the fact that early weaning or complete lack of breast feeding is so prevalent may contribute to the large number of pathologic dirt-eaters found. Twenty-eight (47%) of our cases were not breast fed. Of the 32 who were breast fed, 22 were weaned before the age of 6 months, and 10 between 6 and 10 months.

At least 5 of the cases had evidence of emotional difficulties caused by broken families, neglect, jealousy, fear, rejection, etc.

The habit may be initiated or aggravated through association with other dirt-eating children. 29 of our patients had one or more siblings who had a history of dirt-eating. 9 of the patients in this series were siblings, and 4 were relatives living in the same house. The literature contains many examples in which the child learned the dirt-eating habit from the mother; ^{4,8,19,23} none of the mothers in this series, however, ate dirt.

The literature contains many cases in which dirt-eating is associated with hookworm or other intestinal parasitic diseases. ^{1,2,4,12,}

^{15,18,19,22-25} Each patient in this series had 3 stool examinations for ova and parasites. *Giardia lamblia* was found in 3 cases. No other parasites were found.

It is felt that parasitic infestation, if it occurs, is the result rather than the cause of dirt-eating. Intestinal parasites, with the exception of pin worms, are not common in this area, probably due to the dry climate.

Dirt is easily recognized and can be seen in the feces for as long as 10 days after the dirt-eating has stopped. x-rays of those patients admitted to the hospital became negative for dirt in from 3 to 10 days, but some of those children treated at home still had gross dirt in the stools and positive x-rays for several weeks, thus indicating that the dirt-eating had continued.

It does not appear that these dirt-eating children are suffering from a craving for salts, minerals, or other food substances as some reports indicate. ^{2,4,8,19} Normal blood calcium, inorganic phosphorus and alkaline phosphatase were found by Van der Sar and Wazsink²⁷ and these tests were also normal in the 5 cases in our study in which the tests were performed. The majority of the patients received adequate nourishment and those admitted to the hospital were carefully watched for special cravings or desires. None were seen.

There are three particularly interesting findings in dirt-eating patients. The most striking of these is the moderate to severe anemia. In 26 of the 60 cases, blood counts were known to be normal before dirt-eating began (table 1). The second important finding was the achlorhydria, which occurred in all 60 cases. The third interesting finding was the rapid improvement in the anemia after administration of cobalt-iron mixture. The anemia was hypochromic, microcytic, and relatively refractive to ferrous sulfate as compared to treatment with ferrous sulfate plus cobalt therapy. The administration of cobalt iron mixture corrected the anemia in from 6 to 12 weeks.

It has been thought that some children eat dirt because of the need to neutralize the pain caused by excess gastric acidity.^{1,19} None of the cases in this study had hyperacidity.

One control case (Case No. 55), hospitalized and given no hematinic; remained free of hydrochloric acid in the fasting specimen, and in specimens following the test meal, for 2 months, until treatment was started. However, there was slight improvement in the hemoglobin concentration during this time. Follow-up gastric analysis on all treated cases disclosed a return of normal acidity in 3 to 4 weeks.

Diocetyl sodium sulfo-succinate was found to be very effective in correcting the constipation which was present in most cases.³⁴

Those patients who were treated at home stopped eating dirt within about a week after the treatment was instituted. A few children, however, continued to eat dirt for as long as 3 to 4 weeks after treatment began. Usually the anemia began to improve before dirt-eating stopped.

It is strange that dirt-eating, which started in a child who was not anemic, should stop so promptly when effective medication for the correction of the anemia started. We know that most of the dirt-eaters spontaneously stop eating dirt before the 3rd year. It is probable that this fact, plus closer parental supervision after the cause of the illness is known, is of more importance than any habit-breaking virtue in the cobalt-iron mixture.

Sometimes the parents are unaware that their child eats dirt and are even mortified at the thought to such an extent that they are reluctant to admit the fact. The diagnosis can usually be confirmed by examination of the stool for dirt, or by x-ray of the abdomen.

Comment

Pediatricians who read this article might well question what seems to be a "new" entity. Most of us have considered occasional dirt-eating a rather common, practically normal occurrence of childhood. We have related the pathologic significance of the act or "habit" to the fact that it might serve as a means of acquiring infection or infestation. If extensive and prolonged, it has been considered evidence of poor parental management.

No reference to dirt-eating as a cause per se of anemia could be found in American literature. Although articles are found in foreign literature which definitely describe this syndrome, they are few^{14,15} and are apparently not generally recognized or appreciated.

Most of the cases in this series would previously have been considered cases of "refractory nutritional anemia" or of secondary anemia due to infection, since the response to iron medication is usually slow and is often poor.

Although the cases presented are from a low income group where a certain degree of periodic food deficit is probably common, there was little evidence of severe nutritional deficiency. The incidence of infection was low, and none was found of the severity or chronicity which reasonably could account for the anemia.

All of us can recall children with severe secondary anemia in whom we were unable to definitely demonstrate a nutritional or an infectious cause. It is in this group that the dirt-eaters will be found.

It has been an invariable finding in this clinic that x-ray evidence of dirt in the colon is found only in patients with anemia. Our radiologists who review films from a large surrounding area have often surprised the referring physician by suggesting the presence of anemia, often unsuspected, merely from the routine reading of an abdominal or even a chest film in which a portion of the upper abdomen was visible.

Summary

Geophagia (dirt-eating), a special form of pica, is a common phenomenon and may cause anemia in children. A review of the literature concerning this problem is briefly reported. 60 cases of geophagia with anemia, ranging in age from 11 1/2 months to 4 10/12 years, have been studied. The clinical and laboratory data and the treatment of this group are presented. The evidence presented would indicate that extensive dirt-eating is a cause of anemia in childhood.

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