Esperance pica study

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Background and objectives

Pica, the eating of non-foods, occurs particularly in children and pregnant women. It has been observed in communities all over the world. Pica is associated with iron deficiency and, in some environments, lead poisoning. This is the first time a study has assessed the prevalence of pica in Australia.

Methods

The study assessed the prevalence of pica in an Australian rural community, using a questionnaire given to parents of 223 children aged 2–10 years attending the five general practice surgeries in the shire.

Results

The prevalence of non-ice pica in the study group was 9.4%, and 3.6% of this group ate soil.

Discussion

The presence of pica should alert the treating clinician to consider iron deficiency and, in the case of polluted environments, lead exposure.

What is pica?

Pica is the Latin for magpie, a bird with a reputation for indiscriminate eating habits. In medicine, the term generally refers to the persistent craving for, or eating of, non-food items.[1,2] One of the characteristics often emphasised is the strength of the craving, which has been likened to that for tobacco or alcohol.[3]

The *Diagnostic and statistical manual of mental disorders*, fifth edition (DSM-5) definition specifically excludes culturally sanctioned eating of non-nutritive substances. This is probably reasonable when pica is being viewed as a mental illness. The essential definition in most pica literature, however, includes culturally sanctioned non-food intake, especially if they are potentially harmful to health.[2,4] Finally, the behaviour must persist beyond 18 months to 2 years of age to distinguish it from infant mouthing of objects.

The most commonly described forms of pica are geophagy (earth), amylophagy (raw starch) and pagophagy (ice). Pica is most common among children and pregnant women, two groups that are at most risk if the eaten substances contain pollutants.[1]

Associations with health

There are also a number of conditions that are frequently associated with pica, including anaemia, renal disease and intellectual impairment. Pica can have various health effects; one of the more commonly reported ones is the lead poisoning of earth-eating children who live in lead-polluted environments.[5,6] Furthermore, geophagy is frequently associated with iron deficiency.[7–11] As the minerals in soil can reduce absorption of micronutrients such as iron, geophagy makes the deficiency worse.[12]

In polluted environments, the relationship between iron deficiency, geophagy and lead poisoning becomes complex. The soil supplies the ingested lead and at the same time, by binding ingested iron, results in less iron being available to compete with lead for transport across the duodenal mucosa. Further, as iron deficiency develops, activity of the duodenal divalent cation pump increases, resulting in more efficient uptake of the ingested lead.[6] At its most extreme, pica can result in intestinal obstruction.[13]

Aetiology

Many explanations have been offered for pica, some of which may only relate to certain populations. In some populations it is considered abnormal, and possibly dangerous, not to eat soil in pregnancy.[14] This is the cultural theory of pica. Another frequent observation is that for some groups, the taste and texture of soil in the mouth has an overwhelming appeal. This is the so-called organoleptic model.[15,16] There are physiological theories based on the frequent observation that certain micronutrient deficiencies are associated with pica. Iron and zinc deficiency are the most frequently quoted associations with pica.[7–11,17]

An emerging theory for the explanation of pica is that it serves useful immune functions by the ingested microorganisms stimulating the innate immune system,

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resulting in less response to allergens and autoantigens. This is basically an extension of the hygiene hypothesis. The original hygiene hypothesis was based on the observation that hay fever was less common in children with more siblings; in particular, the greater the number of older siblings, the stronger was this effect. This led Strachan to conclude that the frequent infections passed between children in large households protected against the development of allergic conditions such as hay fever and eczema.[18]

Epidemiological studies following Strachan's work have shown that prenatal and early childhood exposure to farm life reduces allergic illness.[19,20] The farm environment offers many exposures to a wide range of microorganisms and their broken down components, and so, this effect of farm life has been seen as another manifestation of the hygiene hypothesis. From various epidemiological and laboratory lines of evidence, there is an emerging understanding of the advantages of the innate immune system being stimulated by pathogens and their component parts, and how they protect against allergic and autoimmune conditions. Such stimulation may be provided by ingesting a variety of microorganisms and their broken down components via pica, especially geophagia. Callahan has suggested that geophagia may be a means by which the gut diversifies its microorganism flora.[21] There is currently increasing interest in the importance of a healthy gut flora.

Prevalence

Geophagy in African populations has been the focus of a large number of pica studies. These studies have shown prevalence rates of 28–100% in pregnant women and up to 77% in African children.[1,22] Geophagy at lesser rates has also been reported from numerous other human populations. Indeed, geophagy has been noted to be common among many animal species other than humans, including many of our primate relatives.[23]

The prevalence in Australia is unknown. In 1979 Eastwell observed that clay eating had become common in some coastal towns in northern Australia and noted there were 19 habitual clay eaters in a town of 400–600 people.[24] There are no other published estimates of the prevalence of pica in Australia. There are also no Australian studies of the amounts ingested by those who practice pica. In 1975, a study of a random sample of paediatric admissions in Christchurch, New Zealand, found pica in 24 of the 170 children aged 1–5 years inclusive (14%).[25]

The primary aim of this study was to estimate the rate of pica among children attending general practices in an Australian rural community. Secondary aims were to determine the range of substances and gain some idea of the quantities ingested.

Methods

Parents of children attending the five general practices in Esperance, Western Australia, during a period of seven months were encouraged by receptionist staff to fill out a simple questionnaire while waiting to be attended. The doctors did not distribute the survey so that patients would feel less coerced into completing the survey. The population being sampled was children aged 2–9 years inclusive. The questionnaire asked simple questions to assess the amounts and types of non-food substances ingested and how frequently they were eaten. Pica was defined as the ingestion of non-food substances at least once a week.

Ethics approval was obtained from the University of Western Australia Human Research Ethics Committee(reference number RA/4/1/8097).

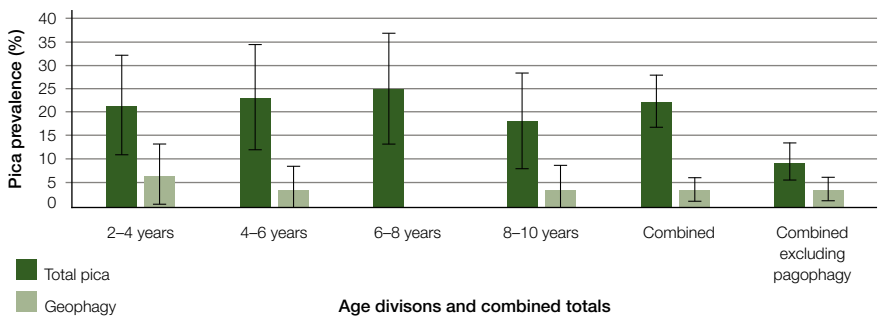

Figure 1. Pica by age groups

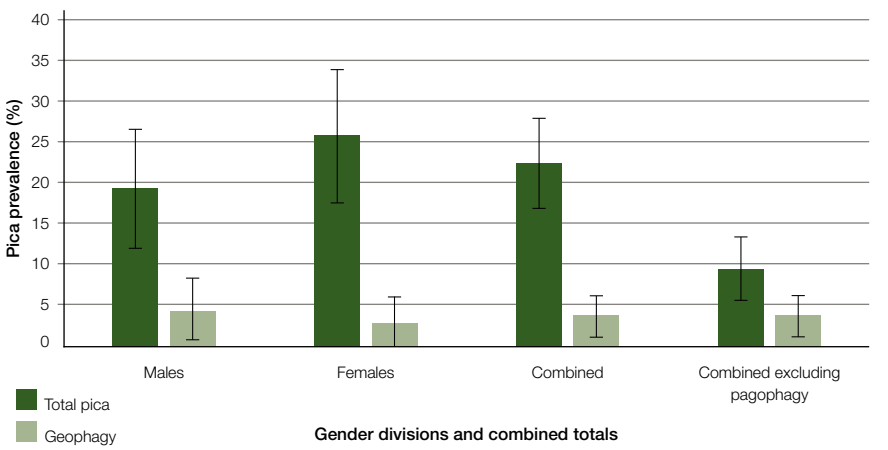

Figure 2. Pica by gender

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Results

There were 223 useable results after 19 results were discarded because of questionnaires that were not properly completed. This study sample size is comparable to many of the international pica prevalence studies and, on the basis of Australian Bureau of Statistics census data for 2011, represents 14.5% of the local 2–10-year population. For data analysis, results were split into four two-year age intervals, each containing 52– 60 children. There were 109 female and 114 male participants.

The major finding was that pica occurred in 50 of the 223 participants (22.4%; 95% confidence intervals [CI]: 16.9%, 27.8%). The most common form was pagophagia (the habitual eating of ice), which occurred in 34 children. If ice is excluded, there were 21 children, 9.4% of those sampled (95% CI: 5.6%, 13.2%), exhibiting non-pagophagic pica. Geophagia occurred in eight of the 223 participants (3.6%; 95% CI: 1.2, 6.0%). Figures 1 and 2 and Tables 1 and 2 show the spread of the data for children displaying pica. There were no significant differences between the different age divisions or between male and female children (Figures 1, 2).

There were some unusual cases, including one child who ate slaters (*Armadillidium* genus), three who ate grass, four who ate cloth in various forms, and eleven who ate paper. It was very common for children to have more than one pica substance.

Quantities of pica substances ingested were estimated by parents, using simple household measures, including a teaspoon, half cup and a cup. Of the geophagia cases, seven ate about half a cup once a week. Of the paper eaters, 10 ingested half a cup or more. The other forms of pica did not show significant ingestion quantities.

Discussion

Pica is a behaviour that has been observed in many cultures, especially in children and pregnant women.[1] The prevalence varies greatly between different populations. There being no previous studies to document the rate of pica in Australia, this study was undertaken to answer questions about the rate of pica among Australian children.

The major findings are that pica of some form, including pagophagy, occurred in 22.4% of children in the study and 9.4% of the children when pagophagy was excluded. Geophagia occurred in only 3.6% of the children. There were no significant differences between overall rates of pica among different age groups or between males and females. The overall prevalence of pica was not dissimilar to that found in children in Christchurch, New Zealand, four decades ago during an investigation into lead exposure.

Geophagia becomes a significant risk in polluted environments and, with a potential prevalence of geophagia of 3.6%, it would seem well worth enquiring about it in such environments. As noted above, pica tends to occur in people with iron deficiency and thus its recognition may lead to an important diagnosis and treatment.

Table 1. Frequency of pica

	Soil	Paper	Paint	Hair	Ice	Other
Never	184	167	205	194	70	154
Less than once a month	22	32	10	14	60	7
Once a month or more	6	10	4	6	57	6
Once a week or more	8	10	1	5	26	4
Daily or more	0	1	0	1	8	8
Did not respond	3	3	3	3	2	44
Total	223	223	223	223	223	223

Table 2. Pica substances

Amount	Soil	Paper	Paint	Hair	Ice	Other
None	188	167	196	191	84	142
About a tablespoon	17	35	16	21	78	15
About half a cup	8	8	0	0	42	2
About a cup	0	1	0	1	8	1
More than one cup	0	1	0	0	6	3
Did not respond	10	11	11	10	5	60
Total	223	223	223	223	223	223

Weaknesses of the study

The enthusiasm with which the different practices embraced the survey varied. It is possible that this led to a sampling bias. Some patients do not attend the general practices of the town because they live near the shire boundaries, closer to other towns, which would bias towards town dwellers.

Pica studies seldom define a boundary for how frequently a person needs to eat non-food substances, or how much they need to eat to be considered as having pica.[2] In this study, an arbitrary boundary was chosen, namely that if non-food substances were ingested more often than once a week then the person was said to have pica.

Implications for general practice

- Pica, other than pagophagy, was found in 9.4% of children, and geophagy in 3.6% of this group of children.

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- It was common for children with pica to eat more than one non-food substance.
- Pica is commonly associated with iron deficiency. Iron studies should be done on patients with pica.
- In industrial, polluted environments, geophagia may lead to lead poisoning. Children practising pica in polluted environments should have their whole blood lead level measured as per the National Health and Medical Research Council recommendation.[5] The presence of old house-paint counts as a polluted environment.
- Both iron deficiency and elevated blood lead levels have been associated with impaired neurocognitive development.

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References

1. Young SL. Pica in pregnancy: New ideas about an old condition. Ann Rev Nutrition 2010;30:403–22.
2. Lacey EP. Broadening the perspective of pica: Literature review. Pub Health Rep 1990:105:29–35.
3. Young SL, Wilson MJ, Miller D, Hillier S. Toward a comprehensive approach to the collection and analysis of pica substances, with an emphasis on geophagic materials. PLoS One 2008;3:e3147.
4. American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 5th edn. Arlington, VA: American Psychiatric Association, 2017.
5. National Health and Medical Research Council. Managing individual exposure to lead in Australia – A guide for health practitioners. Canberra: NHMRC, 2016.
6. Kwong WT, Friello P, Semba RD. Interactions between iron deficiency and lead poisoning: Epidemiology and pathogenesis. Sci Total Environ 2004;330:21–37.
7. Borgna-Pignatti C, Zanella S. Pica as a manifestation of iron deficiency. Expert Rev Hematol 2016;9:1075–80.
8. Geisser P, Shalman C, Prince R, Mutemi W, Friis H, Lowe B. Geophagy iron status and anaemia among pregnant women on the coast of Kenya. Trans R Soc Trop Med Hyg 1998;92:549–53.
9. Kettanch A, Eclache V, Fain O, et al. Pica and food craving in patients with iron deficiency anaemia: A case control study in France. Am J Med 2005;118:185–88.
10. Khan Y, Tisman G. Pica in iron deficiency: A case series. J Med Case Rep 2010;4:86–88.
11. von Garnier C,Stunitz H, Decker M, Battengay E, Zeller A. Pica and refractory iron deficiency anaemia: A case report. J Med Case Rep 2008;2:234–36.
12. Hooda PS, Henry CJ, Seyoun TA, Armstrong LD, Fowler MB. The potential impact of soil ingestion on human mineral nutrition. Sci Total Environ 2004;333:75–87.
13. Serour F, Witzling M, Frenkel-Laufer D. Gorenstein A. Intestinal obstruction in an autistic adolescent. Ped Emerg Care 2008;24:688–90.
14. Njiri H, Elchalal U, Paltiel O. Geophagy during pregnancy in Africa: A literature review. Obstet Gynaesurvey 2011;66:452–59.
15. Lin JW, Temple L, Trujillo C, Mejia-Rodrigues F Rosas LG, Fernald L et al. Pica during pregnancy among Mexican-born women: A formative study. Maternal Child Nutr 2015;11:550–58.
16. Livingstone D. The last journals of David Livingstone in Central Africa from 1865 to his death. London: John Murray, 1874.
17. Cavdar AO, Arcasoy A, Cin S, Babacan E, Gözdasoglu S. Geophagia in Turkey: Iron and zinc deficiency, iron and zinc absorption studies and response to treatment with zinc in geophagia cases. Prog Clin Biol Res 1983;129:71–97.
18. Strachan DP. Hay fever, hygiene and household size. BMJ 1989;299:1259–60.
19. Riedler J, Braun-Fahrlander C, Eder W, et al. Exposure to farming in early life and development of asthma and allergy: A cross-sectional survey. Lancet 2001;358:1129–33.
20. Stein MM, Hrusch CL, Gozdz J, et al. Innate immunity and asthma risk in Amish and Hutterite farm children. N Eng J Med 2016;375:411–21.
21. Callahan GN. Eating dirt. Emerging Infect Dis 2003;9:1016–21.
22. Abrahams PW. Soils: Their implications to human health. Sci Total Environ 2002:291:1–32.
23. Krishnamani R, Mahaney WC. Geophagy among primates: Adaptive significance and ecological consequences. Anim Behav 2000;59:899–915.
24. Eastwell HD. A pica epidemic: A price for sedentarism among Australian ex-hunter-gatherers. Psychiatry 1979;42:264–73.
25. Shellshear ID, Jordan LD, Hogan DJ, Shannon FT. Environmental lead exposure in Christchurch children: Soil lead a potential hazard. N Z Med J 1975;81:382–86.

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