

## TOPICS IN PEDIATRICS

## Pica

Silvestre Frenk,<sup>1</sup> María Amparo Faure,<sup>2</sup> Sandra Nieto,<sup>1</sup> Zazil Olivares<sup>1</sup>

*Mad with desperation, Rebeca got up at midnight and ate handfuls of earth in the garden ..., crying with pain and fury, chewing tender earthworms and chipping teeth with snail bones.*

**Gabriel García Márquez**  
**100 Years of Solitude**

The dramatic explosion with suicidal tinges, whose masterly description is given here, brings to life an acute psychotic episode in the context of a long persistent behavior, since from 11 years of age it was "...discovered that Rebeca liked to eat only moist dirt from the yard and only lime cakes which she pulled from walls with her nails...she practiced this habit secretly and with a guilty conscience... when no one would see her."<sup>1</sup>

This moving tale has served as a paradigm for the phenomenon known as pica.<sup>2,3</sup> In truth, it describes the deep and powerful neuropsychological-metabolic mechanisms that from early stages of life and during all of its course normally generate, regulate and, when they are expressed in the pica phenomena, also specifically disrupt development of the physiological control of appetite and taste.

It is also common to refer to this disorder according to the name of the magpie (*Pica pica*) in association

with the recognized character of this bird to storage of all kinds of non-food materials, particularly some very colorful ones.<sup>3,4</sup> Some attribute this resemblance to a joke by Ambrosio Paré.<sup>5</sup> Other sources place the origin 1000 years earlier, during the 6<sup>th</sup> century according to the writings of Aetius of Amida.<sup>3</sup> Certainly, the clinical picture is mentioned by Hippocrates in one of his aphorisms, by Sophocles who called it "alotriophagia" and later by Aristotle, supposedly naming it geophagia, a term that currently refers to the habit of eating earth materials (the most common of all forms of pica), although there are other denominations.

The pica phenomenon has been the subject of vast writings, mainly historical or anthropological in nature, but in which also abound brief clinical notes, often equipped with descriptions of various outbursts of eccentricity or magical thinking. From time to time there also appear very informative and extensive monographs on the subject: one work that is already a classic and another very recent and excellently documented work with a clear socio-anthropological approach.<sup>3-6</sup>

Pica is defined as an intentional eagerness, repetitive and persistent action lasting more than a month, of swallowing, chewing, sucking or licking substances that as a whole or individually are not considered to be food or of obsessively consuming enormous amounts of some foods or specific condiments.<sup>4-6</sup>

Variouly, pica has been classified according to one of the very general areas of an abnormality in behavior or as

<sup>1</sup> Unidad de Genética de la Nutrición, Instituto de Investigaciones Biomédicas, Universidad Nacional Autónoma de México, Instituto Nacional de Pediatría

<sup>2</sup> Laboratorio de Inmunología, Hospital Infantil de México Federico Gómez

Mexico D.F., Mexico

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a food–taste perversion.<sup>6</sup> It is essential to differentiate the expressions of normal exploratory behavior of an infant from a pathological phenomenon such as pica.

It has become a reason for controversy that the ingestion of pica should be identified as the collective ingestion of extravagant and unusual non-food materials according to community uses and customs, accepted when not obligatory, with religious, magical or ceremonial purposes, but that lack the definition of compulsive character. In turn, eating disorders, such as specific bulimia (also known as malacia) or cases of excessive drug ingestion do tend to be catalogued as pica. Obviously, the anxious consumption of dirt or other materials as an extreme resource for, at least momentarily, trying to satisfy or mitigate tremendous hunger, when there is collective or individual lack of food cannot be classified as such. Nor can the use of earth compounds for therapeutic means, supposedly specific, as has happened since the times of Lemnia *terra sigillata*, whose spectrum of theoretic or real effectiveness went from potentially lethal poisons to trivial drugs including old and recent antipyretic, anti-flatulence, anti-diarrheal drugs.

All of this also underlies the cultural and periodically changing concept of what or what is not food. We should take into account that some of those items that were formerly classified as witchcraft, satanic or inedible vermin have become, over time, delicious and costly gourmet food items.

## SPECIFIC FORMS OF PICA

The relation of organic or inorganic materials recognized as reasons for pica is long and varied. Table 1 presents a compendium of about 75 reports in the medical literature, as well as the academic designations, popular and proposed, of the corresponding types of pica.<sup>7-20</sup> The forms that occur most frequently are underlined.

Its name is usually constructed, totally or in part, from the Greek or Latin name of the material in question, followed by the suffix “phagia” which, in turn, is taken from the Greek *phagein*, meaning “to eat.” There are exceptions to this rule such as taxonomy, certain pre-Hispanic roots or vernacular idioms. Occasionally the suffix “mania” is used. Of course, as the observation of pica cases increases due to the predilection for new materials, the uncertainty about how to des-

ignate the concept also increases, which is indicated in the table with a question mark. Pica is almost always selective for only one material. However, as time passes, this can be changed for something different that occasionally substitutes one of similar nature. In any case, ingestion of clay or other earth materials (geophagia), raw starch (amylophagia), and ice (pagophagia) are the most common forms of pica.

## MODALITIES

### Pica in childhood

At this stage of development, pica typically gains visibility in preschool and early school-age children and occasionally in older school-age children and adolescents who are generally considered physically and psychologically normal. There are individuals who perpetuate their pica into adulthood. Moreover, in addition to presenting in children in foster homes or in care facilities, pica tends to be found as a clinical sign in certain cases of hyperactivity-attention deficit syndrome, in patients with mental retardation<sup>21</sup> and autism, as well as in patients with metabolic disorders such as celiac disease,<sup>22</sup> sickle cell disease,<sup>17,23</sup> or Prasad syndrome characterized by lack of iron and zinc.<sup>24</sup>

The predominant forms of pica in children are the various modes of geophagia including ingestion of caliche layers of old walls once painted with white lead (lead carbonate, sweet flavor). Consequently, these represent a major cause of poisoning in this age.<sup>7</sup> Zoophagias are not exceptional, particularly earthworms and snails. Because the substance or the material that is the motive for the pica is purposely chosen, sought and obtained in an active and purposeful manner, mobility and autonomy are basic conditions. Thus, diagnosis of pica does not exist in children <2 years of age.<sup>3</sup>

During childhood and adolescence or in adults with a disability, pica is usually not only demeaning but stigmatizing. Understandably, except in children who are provocateurs or exhibitionists, this habit is practiced in secret and with a guilty conscience. As with other aberrant behaviors such as sleepwalking, pica not only humiliates its victims but also embarrasses their close relatives and, where possible, is hidden, causing further anguish and self-reproach. This may explain the exceptional nature of pica as a spontaneous reason for medical consultation, but unfortunately is also excluded from the clinical interrogation, which makes one suspect that by having experienced

**Table 1.** Materials motivating pica and their formal or proposed designation<sup>5-20</sup>

| <i>Materials</i>                                     | <i>Formal or proposed designation</i> | <i>Materials</i>                        | <i>Formal or proposed designation</i> |
|------------------------------------------------------|---------------------------------------|-----------------------------------------|---------------------------------------|
| Oil, olives                                          | Oleophagia                            | Bones                                   | Osteophagia                           |
| Water, various clear liquids                         | Potomania*                            | Rubber (foam, gloves, tires, erasers)   | Ulliphagia                            |
| Cotton (blades, swabs)                               | Gosipophagia                          | Soap                                    | Sapophagia                            |
| Raw laundry starch, glue                             | Amilophagia**                         | Tomatoes (skins)                        | Licopersicophagia                     |
| Clay, sand, mud, bricks, earth                       | Geophagia, geomania**                 | Wool (sweaters)                         | "Jumperphagia"                        |
| Rice (raw)                                           | Rizophagia                            | Lettuce                                 | Lectophagia                           |
| Arthropods, insects                                  | Arthropophagia, entomophagia          | Earthworms                              | Lumbricophagia                        |
| Sugar                                                | Sacarophagia                          | Wood (chips, toothpicks)                | Lignophagia                           |
| Sodium bicarbonate                                   | Alkalinophagia                        | Magnesium (carbonate)                   | Magnesiophagia*                       |
| Hair                                                 | Tricophagia                           | Metals (bullets, screws, coins, others) | Metallophagia                         |
| Peanuts                                              | Goberophagia, araquidophagia          | Naphthalin (p-dichlorobenzene)          | Naphthalinophagia                     |
| Coffee (grounds, granules)                           | Gavophagia                            | Oysters (shells)                        | Ostrophagia                           |
| Caliche of old walls, mortar (mixed), bricks, stones | Geophagia, lithophagia**              | Potatoes (peels, flakes, raw)           | Geomelophagia                         |
| Garden snails                                        | Cocleophagia                          | Paper (newspaper, toilet paper)         | Papirophagia                          |
| Charcoal                                             | Carbophagia                           | Paraffin                                | Paraffinophagia                       |
| Boxes                                                | Cartophagia                           | Glues                                   | Adhesivophagia                        |
| Eggshells                                            | Cuasicarovophagia                     | Nonedible plants (grass, others)        | Fitophagia                            |
| Ashes                                                | Estacophagia                          | Plastics (bags, toys, others)           | Plasticophagia                        |
| Matches (used)                                       | Cautopyreiophagia                     | Feathers                                | Plumophagia                           |
| Chicle                                               | ?                                     | Stuffing, felt material                 | ?                                     |
| Cosmetics, lipstick                                  | ?                                     | Paints                                  | Pictophagia                           |
| Dental paste                                         | ?                                     | Polystyrene                             | Polystyrenomania                      |
| Toilet cleaners                                      | ?                                     | Baking powder                           | Coniophagia                           |
| Home detergents                                      | ?                                     | Roots                                   | Rhizophagia                           |
| Sponges                                              | Spongiophagia                         | Salt                                    | Salinophagia*                         |
| Flowers                                              | Floriphagia                           | Blood                                   | Hemophagia                            |
| Raw beans                                            | Faseolophagia                         | Tobacco (pieces, butts)                 | Tobaccophagia                         |
| Raw garbanzos                                        | Cicerophagia                          | Talcum                                  | Coniophagia                           |
| Tailor's chalk                                       | Plumbophagia (by inference)           | Various fabrics                         | Tissuephagia                          |
| Flour                                                | Farinophagia                          | Chalk, plaster                          | Gypsiferophagia                       |
| Fecal matter                                         | Coprophagia                           |                                         |                                       |
| Ice, frost from refrigerator                         | Pagophagia**                          |                                         |                                       |
| Leaves                                               | Foliophagia                           |                                         |                                       |

\*Not necessarily due to pica.

\*\*Predominant materials.

pica at some stage of childhood, the health care professional represses the issue.

Thus, most of the recently published case series relate to isolated cases of ingestion of materials notorious for their exceptional nature. Also, epidemiological information, particularly concerning the prevalence of pica, is not abundant and is discordant and also unreliable. For example, its frequency in the state of New York (U.S.) is reported at 1.7%, whereas in school children in Zambia it is 74.4%.<sup>3</sup>

### Pica during pregnancy

In contrast, pica in pregnant women tends to be acceptable, almost required in certain cultural environments and

understandably often the reason of hilarity, not of derision. Nevertheless, as with other ages and conditions, it is not always a required theme in the medical evaluation or of epidemiological investigation, which is also reflected in glaring discrepancies between the published rates.<sup>25,26</sup> Thus, in a metropolitan area in the U.S., the prevalence of gestational pica was 4.4% in obese African Americans,<sup>27</sup> whereas in women of low socioeconomic status in Ensenada, BC, Mexico, the rate is ten times higher (44%).<sup>28</sup> In contrast, in the wealthy Scandinavian population, gestational pica seems to be exceptional.<sup>29</sup>

Pica during pregnancy tends to appear from the first weeks, so much so that it is frequently interpreted as a

diagnostic sign. One predominant form is pagophagia, defined as the voluntary daily ingestion, and for more than 2 months, of at least one tray of ice cubes or of two or more glasses of shaved ice in quantities reaching up to 9 kg/day.<sup>9</sup> Pagophagia is then a form of pica almost exclusively represented by the urban population from a socioeconomic level that allows for home refrigeration.

In turn, amylophagia and geophagia of pregnancy are, although not exclusive, seen in the rural population but not necessarily impoverished. Amylophagia (raw corn starch) is common in Afro-American women from the deep south of the U.S.<sup>25,26</sup> In addition to its classification due to its frequency as an expression of community pica, it has also been interpreted as a form of addiction as a result of the feelings of satisfaction and emotional stress release and the frequent regression of morning nausea and vomiting when starch is ingested. Even serious emotional expressions, often depressive in character, may occur as a result of starch deprivation.

As another peculiarity, there is the commercial brand as the point of sale of the corn starch that can constitute critical elements for pregnant women subject to this mode of pica.<sup>25,26</sup> With less frequency, such specificity can also be observed in gestational pagophagia.<sup>3</sup>

### Community pica

For its ethnic, cultural and economic polarization, gestational amylophagia may be understood as a periodic flash of cultural microcosm. Hypothetically, it is also prolonged geophagia from childhood and adolescence to adulthood or revealed in subjects already at this stage of life.

Geophagia collectively has undergone intensive anthropological study.<sup>3,4</sup> It is clear that it has been practiced from the earliest ages, exhibiting temporary outbreaks associated with any kind of biological or social phenomena, with occasional touches of individualism. For example, the infamous metal facial covers imposed by African slave owners to keep slaves from eating dirt and avoid lethargy and progressive transition to death has been considered to be an unavoidable consequence of geophagia.<sup>2</sup> This phenomenon in the American South with slaves was known as “African cachexia” and was eventually sustained by historical investigations by Goldberger on the role of niacin in pellagra.

Collectively and individually, geophages tend to be highly selective about which earth materials they consume.<sup>3,26</sup> They

usually prefer clay soils with low humus content from a very specific region. Once obtained, the soil is usually sun-dried or baked which, incidentally, results in sterilization of the soil. In places with large geophagic populations, tablets are sold as “ready to eat.” A special case of the latter are those that are “blessed,” endowed with religious images and consumed for ritual purposes in several Latin American cities, notably in the sanctuary of “Our Lord of Esquipulas.” Although Guatemalan in origin, as the devotion to this image extends north to New Mexico, this type of geophagia is considered by several authors as pica due to the non-compulsive nature of this cultural transmutation.<sup>3</sup>

### TYPE AND NATURE OF PICA

It would appear that, with such a diverse and multifaceted epidemiological and clinical picture, the mere attempt to fully understand its etiology and pathogenesis is a foolhardy venture. The desire is to propose this to atavistic archeophysiological mechanisms involved in the adaptability and survival processes that emerge during certain stages of relative biological helplessness such as in childhood and pregnancy. Due to their primitive nature, they are based on the universal, instinctive devotion to mother earth—to the sacred character of the ground with its tangible components and drinkable water, physically liquid or solid (graspable and therefore chewable), or ice.

As noted above, human geophages (consumers of dirt) at any age are almost specifically ingesters of clay minerals whose particles are the smallest among all earth materials. This gives geophages, in addition to the properties comparable to those of ion exchange resins, a soft consistency that may make them acceptable and palatable. Anecdotal references abound in regard to selectivity, often extreme, to the site of origin or acquisition of earth materials consumed.<sup>3,6</sup>

Little is known about the neurological mechanisms underlying this phenomenon. Pica, like other primitive instincts, is a tributary of the limbic function, in particular, the amygdaloid complex from which emanates both character recognition and conditioning of food aversions and taste preferences.<sup>31</sup> The possibility that pica practitioners perceive endogenous flavors when ingesting materials, which in themselves lack flavor, is illustrative.<sup>6</sup>

In experimental fields, pica stands out as an observable result rather than with neurophysiological investigation. An old observation is that monkeys subjected to selec-

tive removal of the limbic system, in addition to exhibiting noticeable behavioral changes, manifested outrageous episodes of pica with all types of materials and objects. It has recently been shown that rats and mice, species devoid of the vomiting reflex, when subjected to procedures normally emetic, develop avidity for kaolin, which is never consumed under normal conditions. Apparently in this manifestation of experimental pica, peripheral serotonergic pathways are involved.<sup>32</sup> Understandably, pica as a vicariant phenomenon of vomiting, has been adduced as a pathogenic mechanism for pagophagia, amylophagia and geophagia of pregnancy.

### Nutritional slope

The literature with regard to the nutritional aspects of pica, both hypothetical as well as the supposed consequences, is abundant.<sup>6</sup> An interesting hypothesis is sometimes entertained in that certain ruminants obtain some essential minerals by licking or chewing rocks; pica obeys an instinctive process in search of a particular nutrient. In this context, a high rate of geophagia would be expected in those who lack calcium and phosphates, such as in rickets, osteomalacia and osteoporosis, which is not the case. Pregnant women who exhibit pagophagia by virtue of only receiving water have no additional benefit than some relief of morning oral and digestive disorders. It is understood that the salinophagia common in patients with Addison's disease and other adrenocortical insufficiencies or potomania of diabetes insipidus obviously should not be classified as pica when such mechanisms are adaptive.

In turn, the association of pica with specific deficiencies in trace elements, particularly iron and zinc, is an accepted notion. With respect to iron, there is still controversy about whether this deficiency represents a cause or effect of pica. The controversy centers mainly on pagophagia during pregnancy.<sup>25,26</sup> Instead, it is already an accepted notion that pica is associated with specific deficiencies of trace elements, particularly iron and zinc. With respect to iron, there is still controversy about whether this deficiency is related to cause or effect. The controversy centers mainly on pagophagia of pregnancy.<sup>25,26</sup> Evidence for and against each proposal are distributed almost equally. In clinical practice, each case requires individual analysis of the possible relationships.

Geophagia as an instinctive mechanism due to lack of iron because of insufficient iron intake from food is attractive by its simplicity.<sup>33,34</sup> But it falls on the fact that what

tends to be consumed in cases of pica, particularly materials from the ground (such as clay of any color), does not contain sufficient bioavailable iron theoretically to corroborate, even slightly, iron-deficient anemia.<sup>33</sup> Clearly, if an individual has pica and one or more nutritional deficiencies, this does not constitute proof of a causal relationship. This has not been an obstacle for proposing an ingenious, if not amusing, hypothesis. With a relatively high iron concentration in the hypothalamus, this serves as a sensor, capable of triggering reflex mechanisms that result in an aberrant epiphenomenon such as pica.<sup>35</sup>

This may be different in the case of lack of zinc as a detonator of pica. It is supported in the theory by Prasad<sup>24</sup> and in a much more frequent ailment, drepanocytosis.<sup>36</sup> In both disorders there is lack of zinc by virtue of hyperzincuria, caused by a defective resorption of zinc in the renal tubules. Hypothetically, lack of this microelement, conditioned by psychosocial elements, would give rise to geophagia. The physiological role of zinc in the sense of taste must also be kept in mind and whose lack is clinically expressed as hypo-ageusia, the loss of taste perception. This explains the urgency that becomes a compulsion for consuming materials that lack flavor and also odor.

The case of pica, not as a consequence but as a phenomenon that causes specific nutritional deficiencies, is based on the leaching ability of certain earth materials that frequently are the cause of geophagia. These interfere with the intestinal absorption of calcium or potassium or of trace elements such as iron, zinc, copper or others. In this regard, clays from different sites have different effects, which seems to depend on the proportion of particles <0.002 mm.<sup>37,38</sup>

In contrast with such a metabolic malfeasance, the same connecting property of certain clays with trace elements is also manifested with various xenobiotics and plant toxins such as tannins and oxalates. In fact, impoverished populations of California (U.S.) and Sardinia (Italy) use them to detoxify and to make edible and with good taste certain acorns whose flour is used for making bread.<sup>39</sup>

In this way, geophagia would represent, more than an aberrant eating habit, an atavistic evolutionary element for specific human dietary behavior. One would be the adequacy of plant products for consumption, neutralizing their toxins and improving palatability. This is based on the fact that some clay recovered from sites occupied by ancestors of *Homo sapiens* are similar to those consumed by African geophagic populations today. Thus, it is ob-

served that some primitive subsistence behaviors have been transmitted throughout the evolution of those human populations who have access to active clays, as conditioned behaviors.

It is worth recalling the role of nausea and vomiting as preventive mechanisms against the toxicity of various noxious materials and the relationship of these reflexes with geophagia in rodents as conditioned aversion.<sup>39</sup>

With such conditioned learning transmitted to a subconscious level, it would explain that geophagia would remain as a custom in certain human societies. In other societies, it would flourish under certain conditions of biological helplessness such as pregnancy, immaturity or disability, such as compulsive behaviors expressed with the ingestion of dirt or other alternative materials. However, in light of what is already known by the sociocultural facade of community geophagia, the positions are unconvincing—and more political than scientific—that see in this custom a positive health habit.

## MEDICAL AND SURGICAL RISKS

Enumeration of the possible pathological consequences of pica is long. In addition to all that has been pointed out, particularly in regard to nutrition, are also noted hyper<sup>9</sup> as well as hypopotassemia and metabolic alkalosis, among other disorders.<sup>40</sup> The risk of contracting helminthiasis or other infections is minimal, particularly where it is the custom to ideally cook or bake the earth materials prior to consumption. Considering the three most common forms of pica (geophagia, amylophagia and pagophagia) as largely innocuous, they are risks for which an early consideration, diagnosis and treatment for the cases of ingestion of such substances and strange materials capable of having consequences whose solution is surgery. Apart from obstructions and perforations<sup>41</sup> are all types of bezoars,<sup>13</sup> particularly tricobezoars.<sup>42-45</sup> Whereas no more than 1% of cases of trichobezoars exhibit trichotillomania, accompanied or not by the phenomenon (not syndrome) of Rapunzel, they predominate over consecutive obstructions due to intake of glues, plastics or metal,<sup>46</sup> and on the perforations as a result of the latter.

## TREATMENT

In addition to the required surgical management in warranted cases, medical treatment for each individual case of pica,

particularly in children, should be focused on the prevailing pathology, whether dominant or secondary. When there is a proven nutritional deficit, it should be corrected.<sup>47</sup> If pica is associated with a chronic disorder, whether psychiatric, hematological or metabolic, it will be the focus of the patient's management. Recently, treatments for tricotillomania have surfaced.<sup>48</sup> Of course, management of the child who is brought to the physician because of pica requires a comprehensive and validated focus to try and dispel the stigma. Specialized psychiatric management should include techniques that tend to provoke aversion<sup>49</sup> or of pedagogical order to achieve the exchange of materials (reason for the pica) for edible materials.<sup>50</sup> When pica is cultural in nature, any intervention outside social anthropological research must be limited to raising awareness of the risks and, although rare, are no less important for geophagia.

*Correspondence:* Dr. Silvestre Frenk  
E-mail: sfrenk23@hotmail.com

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