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Mansour Sadeghzadeh[1] Parisa Khoshnevisasl[2] and Sina Sadeghzadeh[3]

ABSTRACT The aim of this case–control study was to determine the frequency of pica and its relationship with iron deficiency in children in Zanjan. We selected 872 children and determined the frequency of pica. We selected students who did not have pica of the same age and sex, and in the same class as our cases as a control group. Both groups were evaluated for iron deficiency anaemia. Among the 57 students (6.7%) who had pica, there was no significant relationship with sex (P > 0.05). The most common types of pica were soil (62.3%) and paper (31.2%). The frequency of anaemia among cases was greater than in controls, although the difference was not statistically significant. The serum iron/total iron binding capacity ratio ≤ 0.15 did not differ significantly between the 2 groups. We did not find any association between pica and anaemia and/or iron deficiency (P > 0.05).

Lien entre le pica et les carences en fer chez les enfants à Zanjan, République islamique d'Iran : étude cas-témoin

RÉSUMÉ La présente étude cas-témoin avait pour objectif de déterminer la fréquence du pica et son lien avec les carences en fer chez les enfants de Zanjan. Nous avons sélectionné 872 enfants de manière aléatoire et déterminé la fréquence du pica. Nous avons choisi des élèves en bonne santé du même âge, sexe et de la même classe que nos cas afin de servir de groupe témoin. Les cas et les témoins ont été examinés pour détecter une anémie ferriprive. Parmi les 57 élèves (6,7 %) souffrant de pica, il n'existait pas de lien significatif avec le sexe ($p > 0,05$). Les types les plus connus de pica étaient la géophagie (62,3 %) et l'ingestion de papier (31,2 %). La fréquence de l'anémie parmi les cas était plus élevée que chez les témoins, mais la différence n'était pas statistiquement significative. Le ratio de la capacité de fixation du fer sérique/fer total, inférieur ou égal à 0,15, ne différait pas significativement entre les deux groupes. Nous n'avons trouvé aucune association entre le pica et l'anémie et/ou les carences en fer ($p > 0,05$).

1Zanjan Metabolic Disease Research Centre; 2Zanjan University of Medical Sciences, Zanjan, Islamic Republic of Iran (Correpondence to: Parisa Khoshnevisasl: khoshnevis@zums.ac.ir). 3NODET High School, Zanjan, Islamic Republic of Iran.

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Introduction

Pica is defined as the compulsive eating of non-food material persisting for more than 1 month (1). There are many substances considered as pica such as soil, ice, plaster, cinder, etc. This may vary by ethnicity, culture, race or geographic region (2).

There are several theories to explain pica; one is hunger (3), but given that patients usually consume small quantities of non-food substances between meals, this theory is not fully supported (4). The protection theory maintains that pica is a defensive practice that protects the gastrointestinal tract from absorbing pathogens and chemical substances. Although clay is an effective substance for this (3), more studies are needed to determine this relationship. A protective response to psychological stress is another theory proposed to explain pica (3). The American Psychological Association believes that pica is a psychopathology that needs

therapeutic interventions. Some studies show that pica is usually associated with a number of psychological disorders (4).

Another theory for pica is micronutrient deficiency, e.g. iron, zinc, selenium and calcium. There have been many studies on the validity of this hypothesis (1,3,5). According to this theory, the patients' taste towards the deficient material changes (3). Furthermore, it seems that culture plays a major role in some societies (6). For instance clay is used for fertility and childbearing in Turkey, Africa and Australia (7). Pica may have consequences like gastrointestinal disturbances; lead, mercury or arsenic intoxication; parasitic infestation; or potassium abnormalities (8). The frequency of pica varies from place to place, however, it appears to be more common in children, women, black people, people residing in rural areas and pregnant women (9). Its frequency in the United States of America ranges from 4% among men to 68% in pregnant women and 18.5% in children (10).

Despite the widespread prevalence of pica and its association with multiple health issues, little is known about its causes and consequences. Many researchers have studied the relationship between pica and iron deficiency (11–14); nevertheless, the etiology is still a matter of debate. The frequency of pica and its related factors have not yet been studied in the north-western regions of Iran such as the city of Zanjan. The aim of this study was to determine the frequency of pica and its relationship with iron deficiency in children in Zanjan.

Methods

This case–control study was conducted on students aged 6–15 years in Zanjan in 2012. We selected 872 children from Zanjan elementary schools: 580 girls (66.5%) and 292 boys (33.5 %) were randomly selected from a total of 13 529 students (8228 boys, 5301 girls) by multistage probability sampling. The sampling was carried out in 3 steps. The total number of students in grades 1–5 of elementary schools was determined. The proportion of children in each class was calculated. Assuming that each class has 40 students we determined the number of classes in each age group and based on the percentage of the total specimens, the number of clusters was assigned. We selected 32 clusters (40 students in each class) by simple randomization. The sample size was calculated using the formula: $n = z2 \times p \times q/d2$, where: p = prevalence, d = 0.005, z = 1.96, q = 1–p. Sample size was calculated at 860.

For the control group we randomly choose students who did not have pica of the same age and sex and from the same class as our cases.

We distributed about 1200 questionnaire and 872 were filled in completely by the parents. As participation was voluntary, we did not record reasons for non-participation. Parents gave written informed consent and completed a questionnaire about their children's pica. After collecting the completed questionnaires, the pica-positive students (according to parents) were selected as the case group and a student of the same sex and age in the same class was chosen randomly as control group. We considered about 10 more students in control group. From 872 students only 57 students had pica according to the questionnaires but only 45 students accepted to participate. The control group was 65 students but only 45 accepted to do blood tests.

Both the cases and controls were examined by the researchers and their probable signs and symptoms were recorded. Blood samples were collected and tested for haemoglobin, haematocrit, serum iron and total iron binding capacity. Anaemia was defined as haemoglobin level ≤ 11 /dL and iron deficiency as serum iron to total iron binding capacity ratio ≤ 15% (15–17).

Discrete variables are expressed as counts (%) and compared using the chi-squared test. Statistical analysis was performed by independent t-test and Pearson correlation using SPSS 16.0. Differences were considered statistically significant at P-value

The ethics committee at Zanjan University of Medical Sciences approved this study.

Results

A total of 872 students participated in this study, 580 girls (66.5%) and 292 boys (33.5%). The characteristics of the participants are shown in Table 1 . The children were divided into 3 age groups (6–9 years, > 9–11 years and > 11 years) with mean age 9.40 (standard deviation 2.89) years. Fifty seven students (6.7%) had pica, 36 (63.2%) girls and 21 (36.8%) boys (Table 1). We did not find a significant relationship between sex and pica (P > 0.05).

The reported types of pica were soil in 33 children (3.8%), paper in 17 (1.94%), hair in 10 (1.14%), plaster in 5 (0.57%), cotton thread in 5 (0.57%), plastic materials in 5 (0.57%), cinder in 1 (0.11%) and stone in 1 (0.11%). Pica of paint was not found in our cases. The most common type of pica was soil (62.3% of the cases) followed by paper (31.2% of the cases).

Only 45 of the 57 children in the case group, i.e. those with pica, agreed to have blood tests and

continued the study (30 girls and 15 boys); each of these children was randomly matched with another student in their class who did not have pica of the same sex and age as a control group. The proportion of children with pica increased with age, but there was no significant relationship between pica and age ($P > 0.05$).

The most frequent symptom reported in both the pica case group who agreed to have blood tests and the control group was irritability. Other frequent symptoms included: weakness, paleness and loss of appetite. We did not find any statistically significant difference between the 2 groups in symptoms reported ($P > 0.05$).

The laboratory results for the blood testing are shown in Table 2 . The frequency of anaemia in cases was greater than in the controls although the difference was not statistically significant. There were 3 cases and 2 controls with serum iron 0.05). These findings differ from those of some other studies (3,19,23,24). But at least 2 double blind controlled studies did not find any relationship between iron therapy and pica behaviour (10). This is probably because pica is more a cultural behaviour than a result of iron deficiency. On the other hand, some other studies have shown that pica was common in patients with sickle cell anaemia; these patients usually have high iron levels (22,25). It should be taken into account that pica may also be seen in zinc or other micronutrient deficiency.

A limitation of this study was not measuring the concentration of other micronutrients such as zinc, calcium and selenium.

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