BRIEF REPORT

Amylophagia Presenting as Gestational Diabetes

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Amylophagia, or the practice of consuming purified starch, is a particular expression of the more general phenomenon of pica. This compulsive dietary aberration, observed in many pregnant patients worldwide, is common among rural African American women in the southern United States. The effect this practice has on the course of gestational diabetes has not been examined. We report 2 cases of gestational diabetes, refractory to initial dietary management, in which the patients were consuming one-half to 1 box of cornstarch per day. Following cessation of amylophagia, the gestational hyperglycemia spontaneously resolved. Amylophagia is a complex behavioral phenomenon arising from the interplay of biochemical, hematological, psychological, and cultural factors. In some patient populations, it may represent an often overlooked etiologic or exacerbating factor in the condition of gestational diabetes. Family physicians practicing obstetrics should inquire about amylophagia in patients who are at risk for this behavior and in patients who present with gestational hyperglycemia. *Arch Fam Med. 2000;9:649-651*

Amylophagia, or the practice of eating purified starch, has previously been described as a common practice among pregnant African American patients.[1] Amylophagia is a particular expression of the more general phenomenon of pica, the compulsive ingestion of nonfood items. We report the cases of 2 pregnant patients who presented with hyperglycemia secondary to cornstarch consumption, a clinical entity that we believe to be previously undescribed in the literature.

REPORT OF CASES

CASE 1

A 34-year-old African American woman, para 4-0-0-4, presented for prenatal care at 23 weeks' gestation. Her obstetric history included a cesarean section for cephalopelvic disproportion (third gestation). Her initial prenatal screening test results were within normal limits, except for a normocytic anemia (hemoglobin, 10.7 g/dL; mean corpuscular volume, 88.5 pg). A screening test for sickle cell disease was negative. The patient's (random) serum glucose level was 4.0 mmol/L (72 mg/dL); a urinalysis was negative for glucose. She was prescribed prenatal vitamins with iron.

The patient's 1-hour glucose tolerance test at 26 weeks' gestation revealed a serum glucose level of 8.9 mmol/L (161 mg/dL); her 3-hour glucose tolerance test yielded 2 abnormal values (10.9 mmol/L [196 mg/dL] at 2 hours and 9.0 mmol/L [162 mg/dL] at 3 hours). The patient was diagnosed as having White's class A_2 gestational diabetes.[2] Although her family history was positive for diabetes mellitus, she reported no previous diagnosis of gestational diabetes, and all 4 children had normal birth weights. She was not obese and complained only of polyuria and polydipsia.

The patient was provided with a home glucose monitor and instructed in its use.

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She was also seen by the clinical nutritionist and was prescribed a 2100 kcal/d diet endorsed by the American Diabetes Association (ADA diet). Initially her blood glucose level was well controlled with diet alone; during gestational weeks 28 to 30, however, her fasting glucose levels reached 9.0 mmol/L (163 mg/dL), and her postprandial levels reached 12.9 mmol/L (232 mg/dL).

The patient was admitted to the hospital at 31 weeks' gestation for glycemic control. She continued to observe her ADA diet; blood glucose levels were checked every 4 hours and found to be normal. Initially, house staff suspected noncompliance with diet as the cause of the patient's previously recorded elevated blood glucose levels. On repeated questioning, the patient reaffirmed that she had been compliant with the ADA diet. House staff next investigated the possibility that the patient's home glucose monitor was inaccurately calibrated; however, simultaneous measurements of the patient's glucose level with the outpatient and hospital monitors agreed to within 0.2 mmol/L (3 mg/dL).

On the third interview, the patient reluctantly reported eating up to 1 box of cornstarch per day. No geophagia (eating of dirt) was reported, but the patient did admit to eating up to 1 cup of ice per hour (pagophagia). When questioned as to motivation for the amylophagia and pagophagia, the patient stated that she had "cravings" for the starch and ice, and that eating the substances helped her to feel calmer and less anxious. She knew of no other benefit of the practice. She had told no one of the cravings, and often purposefully arose in the night so that she could eat cornstarch without her husband's knowledge.

The patient was discharged from the hospital and told to return to the ADA diet and prenatal vitamins; she was instructed to monitor her glucose levels as before and to refrain from eating cornstarch and ice. Subsequent overall glycemic control remained excellent, as the patient was able to resist her craving for cornstarch. She did report 1 glucose measurement of 15.9 mmol/L (286 mg/dL), shortly after an indulgence in cornstarch.

At 38 weeks' gestation, the patient was vaginally delivered of a 2.7-kg healthy neonate. At the time of delivery, she showed evidence of zinc and iron deficiency (zinc, 0.38 µg/mL; iron, 10.7 µmol/L [69 µg/dL]; ferritin, 10 µg/mL; total iron binding capacity, 84.3 µmol/L), but no evidence of magnesium deficiency (0.78 mmol/L).

CASE 2

A 32-year-old African American woman, para 3-2-0-4, presented for prenatal care at 29 weeks' gestation. Her history included an intrauterine demise at 24 weeks' gestation, a preterm delivery of a viable infant, a diagnosis of White's class A_2 diabetes during all 4 completed gestations, and delivery of a macrosomic infant (4006 g) during her second pregnancy. Her initial weight was 134 kg. Her prenatal test results were within normal limits, except for a microcytic anemia (hemoglobin, 10.0 mg/dL; mean corpuscular volume, 76.1 pg). She was prescribed prenatal vitamins with iron and given initial dietary counseling. Though she was instructed to return to clinic for a screening glucose tolerance test, she missed her initial appointments.

At 32 weeks' gestation, the patient's 1-hour glucose level was 11.2 mmol/L (202 mg/dL); she was instructed to follow her ADA diet more closely. A subsequent 3-hour test yielded 4 abnormal glucose values of 6.6 mmol/L (119 mg/dL), 13.0 mmol/L (234 mg/dL), 12.6 mmol/L (227 mg/dL), and 8.3 mmol/L (149 mg/dL) (fasting, 1 hour, 2 hours, and 3 hours, respectively). The patient was admitted to the hospital for glycemic control. While receiving a 2600 kcal/d ADA diet with glucose checks every 4 hours, the patient's blood glucose levels normalized without insulin administration. During a review of her history, the patient reported that she had been consuming one-half box of cornstarch per day prior to hospital admission. She did not report other types of pica, and gave no reason for her consumption of starch.

The patient was discharged from the hospital and told to continue following the ADA diet and taking prenatal vitamins with iron. She was instructed to monitor her glucose levels and to discontinue eating starch. She presented in active labor at 35 weeks' gestation; a random blood sample revealed a glucose level of 6.3 mmol/L (114 mg/dL). The patient delivered vaginally a 3.2-kg healthy neonate. Zinc, magnesium, and iron studies were not performed.

COMMENT

Although pica was known to the Greeks and Romans, and has been reported in English medical literature since 1398,[3] it has only recently been actively investigated as a potential etiology of perinatal and fetal morbidity. Depending on the amount and type of substance ingested, potential complications for mother or fetus include iron-deficiency anemia, helminthic infection, and lead toxicity.[4] Complications reported for amylophagia specifically include formation of a gastrolith, parotid enlargement, obesity, and a condition similar to preeclampsia (in a patient eating baking powder that contained sodium bicarbonate and starch).[5-8] A case of transient glycosuria has been reported, but this was in a nonpregnant patient.[5] Given that a typical box of cornstarch contains 1590 cal (86% of which comprise carbohydrates),[9] it is not difficult to imagine that amylophagia could initiate or exacerbate gestational diabetes. In one series, amylophagic pregnant patients consumed, on average, one-half box of cornstarch daily.[10]

Pica is a phenemonon reported in the medical literature from around the world, including Asia, South America, the Caribbean, Africa, Europe, and the Middle East.[3] In the United States, at least 15 studies since 1950 have investigated the prevalence of pica. They indicate

that the prevalence has fallen, from 40% to 60% to about 20% of the pregnant population considered to be at high risk. This population includes those patients who are African American, live in a rural area, occupy lower socioeconomic strata, and possess weak social support networks.[11] Both rural and urban studies have shown that younger patients are more often amylophagic than geophagic. Authors have proposed several factors for this change, including lack of easy access to traditional sources of ingested clays and patients' concern for avoiding the adverse effects of consuming "contaminated" clays.[9,12] In addition, cornstarch approximates the texture of "white" clays, which were traditionally preferred for consumption.[13] By way of comparison, a study from Saudi Arabia reported the overall incidence of pica to be substantially lower (8.8%), and found no correlation between the practice of pica and age, educational level, or economic status.[14]

The correlation between anemia, pica, and nutritional deficiency has been difficult to explain with a single pathophysiologic model. Some investigators contend that pica directly causes anemia.[15,16] The proposed mechanism is malabsorption; the ingested substances bind elemental iron, rendering it unavailable for uptake from the gut. This hypothesis has been tested experimentally with mixed results; one investigator reported decreased absorption in rats,[17] but 2 other studies in humans revealed no change in absorption.[16,18] An alternative nutritional model proposes that the nonnutritive intake from pica leads to a total diet low in nutritive foods, resulting in nutritional deficiency and anemia.[19-21]

Pagophagia (the compulsive consumption of ice) has been shown to respond to iron supplementation,[22] leading some investigators to postulate that pica is the result, not the cause, of nutritional deficiency (specifically, deficiencies of iron, zinc, magnesium, and phosphorus).[23,24] Folk wisdom (and some early investigators)[25] maintained that pica reflected a compensatory appetite. Later research, however, has demonstrated no evidence that the substances ingested provide any nutrient or mineral in which patients are deficient.[26]

More recently proposed etiologies for unusual food cravings include hormonal fluctuations,[27] family[28] or cultural customs,[29-31] and psychopathologic mechanisms (eg, pica as a form of obsessive-compulsive behavior).[32,33] Data exist to support all 4 pathologic models, indicating that pica is likely to be multifactorial in cause. As such, it typically responds best to multiple treatment modalities, including nutritional supplementation, dietary education, and psychological counseling. As the form of pica and its meaning to the patient may be culture-specific, clinicians should be sensitive to the potential for transcultural issues to complicate care.

The cases we report represent 2 instances in which amylophagia was an etiologic or potentiating factor in the development of gestational diabetes. Both women had evidence of hyperglycemia during past pregnancies and iron deficiency anemia during the current pregnancy, but the history of pica was not obtained on initial evaluation. However, repeated review of the history, in the context of developing rapport with the patient, elucidated this important aspect of each patient's case. Although both patients were members of a culture where pica is more prominent, one patient indicated that she was uneasy about revealing her behavior to family members. Her efforts to conceal her consumption significantly interfered with her level of functioning, offering support to the view that pica represents an obsessive-compulsive behavior.

We propose that amylophagia is an often neglected confounding factor in pregnancies complicated by gestational diabetes, particularly among African American women with ties to the southern United States. We therefore encourage further investigation into the prevalence of amylophagia during pregnancy, and include questions regarding pica as part of our routine initial obstetric evaluations.

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starch and some clays on iron absorption. *Am J Obstet Gynecol*. 1970; 108:262-267.
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Correction

Errors in Text. In the original contribution by Balluz et al titled "Vitamin and Mineral Supplement Use in the United States: Results From the Third National Health and Nutrition Examination Survey," published in the March issue of the ARCHIVES (2000;9:258-262), the following errors regarding ingredient names occurred in the text. On page 259, the second tabulation in the "Results" section should have appeared as follows:

Ingredient	Products Containing Ingredient, %
Vitamin C	45.0
Vitamin B_{12}	39.3
Vitamin B_6	39.1
Niacin	39.0
Thiamin	38.0
Riboflavin	37.7
Vitamin E	37.1
Vitamin A	37.0
Vitamin D	34.0
Folic acid	34.0

On page 261, at the top of the page, the common name of the last item in the tabulation should have appeared as "Yohimbe." In the "Comment" section on that same page, the third and fourth sentences of the second paragraph should have read as follows: "On the other hand, large doses of some vitamins, such as vitamin A (retinol), are known to be teratogenic.[15,16] In NHANES III, 3% of those who reported taking vitamin A might be taking potentially teratogenic amounts (≥600 000 IU/mo)." In the fifth paragraph of the "Comment" section, the third sentence should have read as follows: "Many of the products reported, such as black cohosh, chaparral, L-tryptophan, thyroid, and yohimbe, are documented to have serious adverse health effects.[22]" The journal regrets the errors.