

# Kwashiorkor in an 8-Month-Old Infant Due to Homemade Formula Use

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## ABSTRACT

**Introduction:** Kwashiorkor is a malnutrition syndrome most commonly seen in the United States among patients with malabsorptive conditions. While it is rare in otherwise healthy individuals, cases can develop where low nutritional literacy or unorthodox diets are a factor.

**Case Presentation:** We present the case of an 8-month-old infant who developed kwashiorkor after transitioning to homemade infant formula.

**Discussion:** This patient developed severe malnutrition due to consumption of homemade formula that did not meet nutritional standards. The recipe was promoted by an alternative health organization as a healthy option, and the difficulty in identifying reliable health information online also played a significant role.

**Conclusion:** Families of young children face many challenges, particularly during the recent infant formula shortage. Maintaining strong relationships and open communication with trusted health care professionals is vital to combating health misinformation and helping patients and families navigate these challenges safely.

## INTRODUCTION

Kwashiorkor is a syndrome of malnutrition that is generally rare in the United States and is most often associated with malabsorptive conditions. Cases in healthy patients are most often associated with low nutritional literacy or unorthodox diets.<sup>1</sup> Feeding is frequently a high-stress area for parents of infants—especially with recent formula shortages—and the difficulty of identifying reliable

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sources on the internet can put both children and parents at risk. We present a case of kwashiorkor due to homemade formula use in a previously healthy infant.

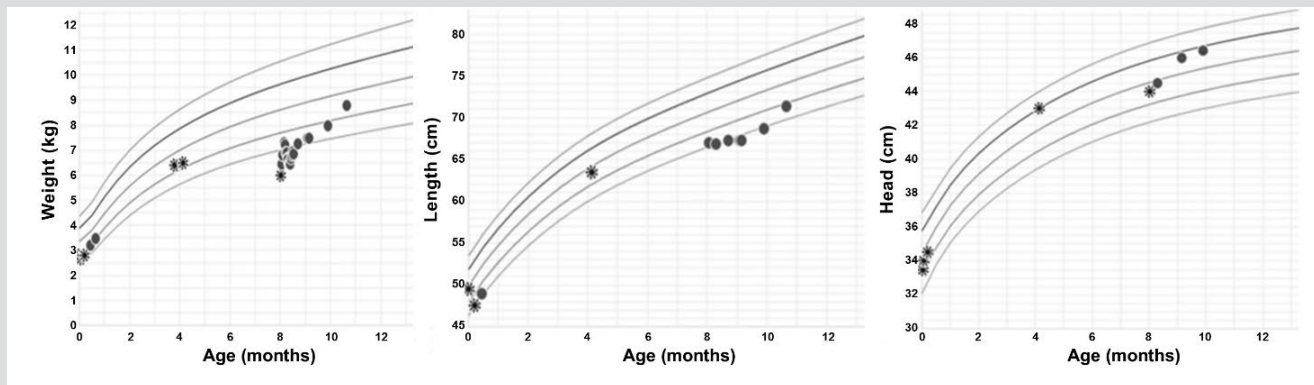
## CASE PRESENTATION

A previously healthy 8-month-old infant presented with poor weight gain, edema, and hypotonia. Vital signs were notable for heart rate 126, blood pressure 58/32, respiratory rate 32, and temperature 36.1°C. His mucous membranes were dry with capillary refill of 3 to 4 seconds and edema of all 4 extremities. He had decreased global muscle tone, minimal spontaneous movement, and was breathing irregularly with subcostal retractions and periods of apnea. Initial labs showed a blood glucose of 47 mg/dL, albumin 2.3 g/dL, total protein

3.9 g/dL, and anion gap metabolic acidosis with bicarbonate 16 mEq/L and lactate 21 mg/dL. Weight at admission was 5.996 kg, down from 6.492 kg 4 months previously; his linear growth had plateaued, and his head circumference growth velocity had slowed, consistent with prolonged malnutrition (Figure). He was placed on high flow nasal cannula for respiratory support and received intravenous fluids and dextrose for resuscitation. His respiratory status and lethargy improved with rehydration and resolution of hypoglycemia. He remained hypotonic with low muscle bulk and head lag and was unable to sit unsupported. Based on his edema, hypoalbuminemia, and clinical signs of severe malnutrition, he was diagnosed with kwashiorkor.

His parents reported that at around 6 weeks of age, he began to show signs of constipation and abdominal pain associated with formula feeds. His symptoms did not improve, despite trying multiple different commercially available formulas, includ-

**Figure.** Patient World Health Organization Child Growth Charts for Weight, Length, and Head Circumference



**Table.** Comparison of Formula Nutritional Content Per Ounce

	FDA Standard	Patient's Formula
Kilocalories	20	9.48
Protein (g)	0.36–0.90	0.05
Fat (g)	0.66–1.20	0.70
Vitamin A (IU)	50–150	486.3
Vitamin D (IU)	8–20	16.37
Vitamin E (IU)	≥0.14	0
Vitamin K (mcg)	≥0.8	0.33
Vitamin B1 (mg)	≥8	0
Vitamin B2 (mg)	≥12	0
Vitamin B6 (mg)	≥7	0
Vitamin B12 (mcg)	≥0.03	0.33
Niacin (mg)	≥50	0
Folate (mcg)	≥0.8	0.06
Biotin (mcg)	≥0.3	0
Vitamin C (mg)	≥1.6	0.38
Calcium (mg)	≥12	23.28
Iodine (mcg)	1–15	0
Iron (mg)	0.03–0.6	0.05
Sodium (mg)	4–12	3.77
Potassium (mg)	16–40	6.59

Abbreviation: FDA, Food and Drug Administration.

ing those recommended by their pediatrician. Although they did not have any difficulty in finding or affording formula, due to their frustration with the lack of improvement after following their pediatrician's suggestions, they transitioned to a homemade, coconut milk-based formula promoted online by an alternative health organization shortly after his 4-month well-child check. After the change in formula, his abdominal discomfort and fussiness improved, and he continued to take 240 mL feeds every 3 to 4 hours. Over the next few months, he remained exclusively formula-fed, but his oral intake slowly decreased and his family noticed slower weight gain. His parents reported they missed his 6-month well-child check and did not reschedule because they had no concerns at that time. He later stopped reaching to grasp objects, and his head control regressed from his previously

achieved milestones. He did not see a health care provider until the day of presentation when his parents became concerned about his lethargy and irritability.

Nutritional analysis of the homemade formula recipe showed that it contained 9.5 kcal and 0.05 grams of protein per ounce and fell below US Food and Drug Administration (FDA) standards for multiple other nutrients (Table).<sup>2</sup> The patient tolerated nasogastric feeds with standard infant formula without signs of refeeding syndrome. He became edematous and showed rapid weight gain following fluid resuscitation, which was expected given his hypoalbuminemia, but spontaneously diuresed the excess fluid and showed appropriate weight gain thereafter. He was discharged home with the nasogastric tube in place due to an aversion to taking formula. He has since transitioned to full oral feedings and has made good progress in regaining motor skills.

## DISCUSSION

Kwashiorkor is characterized by the presence of dependent edema secondary to hypoalbuminemia, and patients also may present with a listless affect, bradycardia, hypotension, and hypothermia. In this case, the formula's low caloric density and negligible protein content deprived the patient of the nutrients necessary for protein synthesis, leading to his development of kwashiorkor. Initial treatment of kwashiorkor is focused on stabilizing the patient through treatment and prevention of hypocalcemia, hypothermia, dehydration, and electrolyte imbalances. After the acute phase has passed, treatment shifts to resuming feeding with the goal of restoring appropriate growth and development.<sup>3</sup>

The internet continues to grow as a source of health information for parents, but the quality of information can vary widely. The immediate availability of health information online has many potential benefits for patients and families, but studies have shown that while large majorities of parents search online for information about their children's health, fewer than 60% check the reliability of the source or verify the information with a physician.<sup>4,5</sup> Although parents are aware that search engines may not provide

safe and reliable information, 80% reported using search engines as their first step in answering health questions.<sup>4</sup> With no enforceable standards for the quality of health information online, it is ultimately up to patients and families to determine the reliability of what they find.

The difficulty in finding reliable information is evident when researching homemade infant formula. The FDA, American Academy of Pediatrics (AAP), and other professional societies and pediatric health organizations all explicitly recommend against homemade formula use, citing potential problems ranging from excess free water content to nutritional deficiencies and unsafe ingredients. Despite this consensus, prior to the recent infant formula shortage, a Google search for “homemade baby formula” returned over 10 million results, with formula recipes displayed on the first page of results, intermixed with sites that highlight the health risks. Furthermore, while all commercially available formulas must meet FDA standards, the standards are not applied to homemade formula.<sup>6</sup> Most recently, the formula shortage has been further exacerbated by extensive recalls, leaving families in difficult situations on how to feed their babies. Whereas advice from the AAP provides families with guidance on how to navigate this formula shortage, alternative advice with recipes for “emergency use formula” are just as readily available on the internet.<sup>7</sup>

## CONCLUSIONS

This case illustrates the potential for serious harm when parents turn to the internet for health information. The patient became critically ill after 4 months of feeding with a formula that was promoted as safer and healthier than commercial formulas. The formula was the direct cause of his kwashiorkor, as illustrated by its nutritional content and his rapid improvement when being fed standard infant formula. With myriad social, economic, and environmental factors often putting patients and parents in near-impossible situations—especially during the recent infant formula shortage—the importance of the guidance offered by health care professionals cannot be understated. Whether through phone or text reminders, outreach after missed appointments, or regular checkins between appointments, it is vital for clinicians to maintain open communication with families to ensure the health and safety of all involved. Preventive care is the foundation of health care and is the most important tool for avoiding adverse outcomes. As this case illustrates, the combination of missed visits and unverified information can lead to disastrous results.

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