


## CLINICAL INQUIRIES

Evidence-based answers from the  
Family Physicians Inquiries Network 

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# Q | What nutritional deficiencies and toxic exposures are associated with nail changes?

## EVIDENCE-BASED ANSWER

**A** | INFANTS WITH IRON DEFICIENCY have a higher rate of koilonychia—concavity of the outer surface of the nail—(strength of recommendation [SOR]: C, one case-control study).

Vitamin B<sub>12</sub> deficiency is associated with various nail pigment changes that are reversible with treatment (SOR: C, case reports).

Muehrcke's lines (transverse white bands that run parallel to the lunula) occur

in a minority of patients with hypoalbuminemia. (SOR: C, one cross-sectional study).

Fingernail clubbing has been found in most patients with kwashiorkor, or protein malnutrition (SOR: C, one cross-sectional study).

Transplacental exposure to polychlorinated biphenyls (PCBs) and polychlorinated dibenzofurans (PCDFs) has been associated with nail deformities and color changes (SOR: C, one case-control study).

## Evidence summary

The evidence linking nail changes with nutritional deficiencies and toxic exposures is sparse, dated, and of low quality. Conditions associated with nail changes include iron deficiency, B<sub>12</sub> deficiency, hypoalbuminemia, protein malnutrition, and PCB/PCDF exposures.

### Iron deficiency is associated with koilonychia

A case-control study of 400 infants in a low-income well-baby clinic found 22 with koilonychia, a prevalence of approximately 5%. Randomly selected age-matched infants without koilonychia served as controls.

Infants with koilonychia had significantly lower hematocrit (30% vs 34%; *P*<.005), hemoglobin (9.4 vs 10.7 g/dL; *P*<.02), and serum iron (50 vs 84 mcg/dL; *P*<.001) than controls.<sup>1</sup>

### B<sub>12</sub> deficiency can discolor nails, but changes are reversible

Four articles describe 5 case reports of pigment changes to nails associated with B<sub>12</sub> de-

fiency, all of which resolved with B<sub>12</sub> therapy. Nail changes included brownish reticulate pigmentation,<sup>2</sup> longitudinal hyperpigmented streaks,<sup>3</sup> bluish-black pigment of all nails with transverse longitudinal hyperpigmented streaks,<sup>4</sup> and entirely blue nails.<sup>5</sup> B<sub>12</sub> levels ranged from undetectable to 113 pg/mL.

### Hypoalbuminemia linked to Muehrcke's lines

A cross-sectional study of 72 patients selected on the basis of general cachectic appearance found 44 to have low serum albumin. Of those, 10 (23%) had Muehrcke's lines. All of the patients with Muehrcke's lines had albumin levels <2.7 g/dL. None of the 28 patients with normal albumin had Muehrcke's lines.<sup>6</sup>

### Kwashiorkor can cause fingernail clubbing

In a cross-sectional study of 60 children 1 to 4 years of age diagnosed with kwashiorkor without evidence of tuberculosis infection, fingernail clubbing was found in 46 (76.7%).

TABLE

## Nail changes linked to nutrition deficits and toxins<sup>9</sup>

Nail change	Associated with
Beau's lines (transverse depressions of all the nails)	Zinc deficiency
Diffuse white nail	Zinc deficiency, anemia
Koilonychia (concave nails)	Iron deficiency
Diffuse brown, black, or white bands	Malnutrition
Diffuse brown nail	Photographic developer
Variable white	Hypocalcemia, thallium toxicity (rat poison)
Muehrcke's lines (transverse, stationary, paired white bands)	Hypoalbuminemia
Mee's lines (transverse white bands)	Arsenic
Longitudinal pigmentation	B <sub>12</sub> or folate deficiency

Clubbing was mild in 26 (43.3%) children, moderate in 19 (37.7%), and severe in one (1.7%).<sup>7</sup> Kwashiorkor is extremely rare in children in the United States and other developed countries.

### Transplacental chemical exposures found to deform and discolor nails

A case-control study compared finger- and toenail findings from more than 100 Taiwanese children exposed transplacentally to high levels of PCBs and PCDFs with nail findings from a comparable number of controls. The investigators looked at parental reports and physical examination results.<sup>8</sup>

Although the rates of nail abnormalities reported by parents of exposed children differed slightly from rates documented by physical examination, children exposed to PCBs and PCDFs had consistently higher rates of nail deformity than controls. The researchers examined 117 cases and 106 con-

trols. They identified dystrophic fingernails in 15% of exposed children and 1% of controls (odds ratio [OR]=15.4; 95% confidence interval [CI], 2-119); dystrophic toenails occurred in 32% of exposed children and 18% of controls (OR=2.2; 95% CI, 1.2-4.1). The most common fingernail deformities were grooves and ridges. The most common toenail deformities were koilonychias, ridges, thickening, and pigmentation changes.<sup>8</sup>

PCB exposure is an issue in the United States and other developed countries, but at much lower levels than the accidental contamination. Whether lower levels of exposure cause nail changes isn't known.

### Recommendations

No recommendations are available. A dermatology textbook lists several nail changes associated with nutritional deficiencies and toxic exposures (TABLE).<sup>9</sup>

**> High transplacental exposures to polychlorinated biphenyls and polychlorinated dibenzofurans can cause nail deformities.**

### References

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