ENTERAL NUTRITION FORMULAS WITH HIGHER OXALATE CONTENT MAY CONTRIBUTE TO HIGHER OXALATE ABSORPTION AND URINARY EXCRETION IN PATIENTS REQUIRING NUTRITION SUPPORT

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INTRODUCTION AND OBJECTIVE: Patients who depend on oral and/or enteral nutrition support to meet their nutrient needs are known to form calcium oxalate (CaOx) kidney stones. Dietary oxalate, if excessive, can contribute to CaOx stones, especially if unopposed by appropriate calcium intake. The oxalate concentration of oral/enteral nutrition formulas is not reported. We assessed various formulas for oxalate.

METHODS: Adult and pediatric oral/enteral nutrition formulas commonly used at inpatient institutions as well as in home feeding regimens were selected. Formulas designed for oral and enteral consumption (or either) were included (table), but completely elemental (hydrolyzed) or modular formula products were not. Multiple samples (N, table) of each formula were acidified, heated, and centrifuged. The supernatants were filtered and analyzed for oxalate using ion chromatography. Oxalate concentration (mg/L±SD), relative standard deviation (SD) between samples (coefficient of variation; CV), and the calcium:oxalate ratio (mg:mg/L of formula) were calculated.

RESULTS: Of 35 formulas analyzed, 9 were excluded due to inconsistent results and high CVs. Results for the 26 remaining formulas are shown (table). Oxalate concentration ranged from 4-140 mg oxalate/L of formula. Due to highly variable calcium content in the formulas, calcium:oxalate ratios varied widely (from 0-286) with lower ratios suggesting higher potential for oxalate absorption. There was no difference between the mean oxalate concentration of enteral vs. oral formulas (45 vs. 46 mg/L; P=0.92). Enteral formulas tended to have lower relative SDs (mean CV 16% vs. 21% for oral formulas), likely due to the generally more complex matrix of oral formulas, which contributed to more analytical variability. Depending on the formula used, a patient requiring 1.5 L of enteral formula daily could obtain anywhere from 12-150 mg oxalate.

CONCLUSIONS: Patients requiring oral and/or enteral nutrition support are at risk for a high exogenous oxalate load depending on the formula ingested and on the bioavailability of oxalate. Patients with a history of or at high risk for urolithiasis would benefit from strategies to reduce the bioavailability of oxalate and urinary oxalate excretion, which may include supplemental calcium with feedings or use of an appropriate lower oxalate formula.

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Table. For each enteral nutrition formula, data show its typically recommended route of administration (oral, enteral, or both/either), oxalate concentration (mean ± SD), number of samples analyzed, coefficient of variation (SD/mean), and calcium-to-oxalate ratio (mg:mg).

Formula	Oral (O), enteral (E), or both (B)	Oxalate mg/L ± SD	N	CV %	Ca:Ox mg:mg
Boost Compact, rich chocolate	O	140 ± 10	3	7.3	17
Boost Breeze, orange	O	132 ± 12	6	8.7	0
Boost Breeze, peach	O	103 ± 3.5	8	3.4	0
Fibersource HN with fiber, complete liquid formula, unflavored	E	99 ± 14	3	14	9.7
Replete 1.0, unflavored	E	79 ± 8.1	3	10	10
Compleat tube feeding formula, 0.6 kcal, unflavored	E	73 ± 3.6	3	4.9	19
Boost High Protein, very vanilla	O	69 ± 19	6	27	21
PediaSure enteral formula, vanilla	B	64 ± 8.3	3	13	16
Novasource renal, 2.0, vanilla flavor	B	62 ± 0.76	3	1.2	14
Boost Plus, rich chocolate	O	52 ± 0.36	3	0.68	28
Boost Compact, very vanilla	O	40 ± 16	3	41	60
Nutren Junior Fiber, vanilla	B	35 ± 6.2	3	18	34
Isosource HN tube feeding formula, 1.2 cal, unflavored	E	29 ± 9.9	3	34	32
Ensure Clear, mixed berry	O	27 ± 4.4	3	17	0
Fibersource HN tube feeding formula, unflavored	E	26 ± 3.0	3	12	34
Boost Breeze, wild berry	O	26 ± 7.4	3	28	0
Ensure Original nutrition shake, vanilla	O	23 ± 9.8	3	43	56
Carnation Breakfast Essentials, RTC, rich milk chocolate	O	21 ± 7.6	3	36	60
Boost Plus, very vanilla	O	18 ± 4.5	3	26	83
Boost Glucose Control, very vanilla	O	17 ± 4.8	6	28	86
PediaSure Grow & Gain, vanilla shake	O	12 ± 2.7	3	22	87
Ensure Plus nutrition shake, vanilla	O	12 ± 2.8	3	23	104
Nutren 2.0 complete liquid nutrition, unflavored	E	9.6 ± 2.0	3	20	140
Nutren 1.5 complete liquid nutrition, unflavored	E	8.4 ± 2.9	3	35	143
Compleat tube feeding formula, reduced calorie, unflavored	E	7.8 ± 1.4	2	17	179
Carnation Breakfast Essentials, RTC, classic french vanilla	O	4.4 ± 0.36	3	8.2	286