

Phosphorus Control in CKD

How to protect your bones and blood vessels from the silent damage of high phosphorus. Covers bone disease prevention, vascular calcification, Filipino food choices, and phosphate binders.



3.5–5.5
mg/dL Normal Range

>5.5
mg/dL = Hyperphosphatemia

Bone Disease
Primary Risk in CKD

Binders
Key Treatment Tool

Phosphorus builds up silently in CKD — normal kidneys excrete it, damaged kidneys cannot. The result: brittle bones, hardened vessels, and increased cardiovascular death.

1 Why High Phosphorus Is Dangerous in CKD

The CKD-MBD Cascade

When kidneys fail, phosphorus accumulates in the blood. This triggers a dangerous cascade:

Step 1: High phosphorus → parathyroid glands sense the imbalance → release excess PTH (secondary hyperparathyroidism).

Step 2: PTH pulls calcium from bones to normalize blood levels → bones weaken → **renal osteodystrophy** (brittle bones, fractures).

Step 3: Calcium × phosphorus product rises → calcium-phosphorus crystals deposit in blood vessels → **vascular calcification** — the "stone heart" effect.

Step 4: Calcified arteries → stiff vessels → hypertension, left ventricular hypertrophy, heart attack, stroke.

Step 5: Phosphorus deposits in skin → severe itching (pruritus), and in the worst cases, **calciphylaxis** (skin necrosis — emergency).

Phosphorus Targets by CKD Stage

CKD Stage	Phosphorus Target	PTH Target
Stage 1–2 (eGFR >60)	Normal (2.5–4.5 mg/dL)	Normal
Stage 3 (eGFR 30–59)	3.5–5.5 mg/dL	35–70 pg/mL
Stage 4 (eGFR 15–29)	3.5–5.5 mg/dL	70–110 pg/mL
Stage 5 / Dialysis	3.5–5.5 mg/dL	150–600 pg/mL

KDIGO CKD-MBD 2017 update · PTH targets are wider in dialysis — discuss with your nephrologist.

2 Organic vs Inorganic Phosphorus — The Key Difference

Organic Phosphorus (Natural Food)

From whole foods: meat, fish, dairy, legumes, grains

Absorption: **40–60% absorbed** — bound to protein, requires digestion to release.

Plant phytate: plant phosphorus is bound to phytic acid — absorbed even less (~20–40%). Legumes safer than they look.

Animal sources: meat, fish, eggs — organic but absorbed more than plant sources.

Examples: bangus, tilapia, manok, baboy, itlog, monggo, gatas, keso

Inorganic Phosphorus (Additives)

From food additives: cola drinks, processed meats, fast food

Absorption: **80–100% absorbed** — free phosphate salts need no digestion; instantly absorbed in the gut.

Far more dangerous: gram for gram, additive phosphorus raises blood levels 2× more than natural food phosphorus.

Label clue: any ingredient ending in "-phosphate" or containing "PHOS" is inorganic.

Examples: Coke/Pepsi, hotdog, longganisa, instant noodles, processed cheese, fast food chicken

⚠ Phosphate Additives: The Hidden Danger

Phosphate additives in processed foods (cola drinks, fast food, processed meats, instant noodles) are absorbed at **80–100%** — they are far more dangerous than natural food phosphorus. Even small amounts cause significant rises in blood phosphorus. **If the label says "sodium phosphate," "phosphoric acid," "pyrophosphate," or "polyphosphate" — avoid it.**

THE CKD-MBD CASCADE — HOW PHOSPHORUS DAMAGES BONES & BLOOD VESSELS

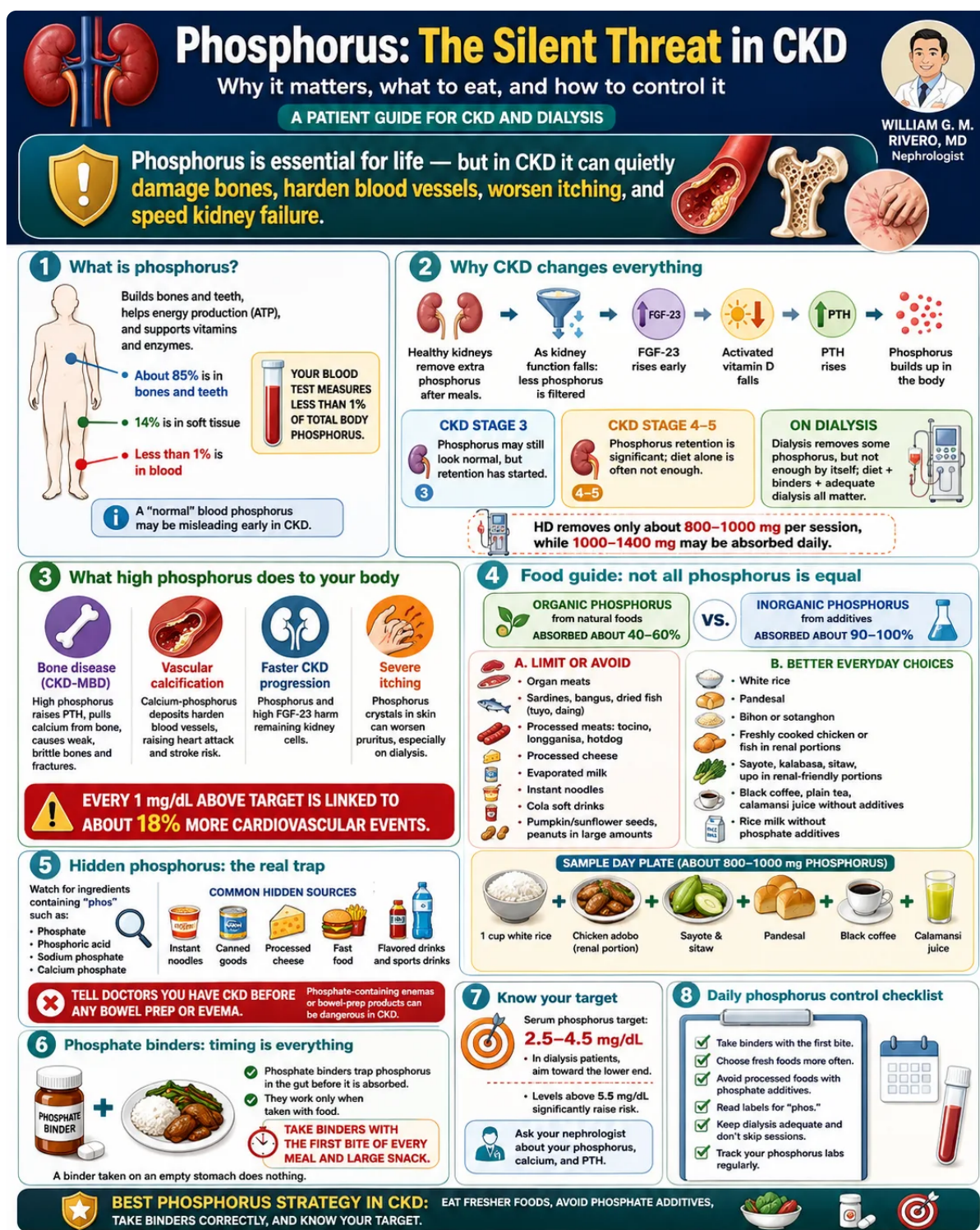


Fig. 1 — The CKD-Mineral Bone Disease (CKD-MBD) cascade: as kidney function declines, phosphorus accumulates in the blood. This triggers excess PTH secretion (secondary hyperparathyroidism), which pulls calcium from bones, causing renal osteodystrophy (brittle bones, fractures). Simultaneously, the calcium × phosphorus product rises, driving vascular calcification — hardening of the arteries that increases cardiovascular risk. Phosphorus control through diet and binders is the cornerstone of preventing these complications. Early dietary restriction (CKD Stage 3) can delay binder initiation and slow disease progression. Target serum phosphorus: 3.5–5.5 mg/dL in CKD 3–5D (KDIGO 2017/2024).

Filipino Foods — Phosphorus Content Reference

Heat-map by phosphorus load · All values per standard serving · Organic sources only — additive phosphorus (cola, processed meats) is far more dangerous regardless of listed mg

Page 3 of 6 · stjohnbicare.com

Food (Filipino name)	Standard Serving	Phosphorus	Absorption	CKD Note
HIGH (>200 MG/SERVING OR ADDITIVE-PHOSPHORUS) — LIMIT OR AVOID IN CKD				
Atay ng manok / chicken liver	100 g cooked	350 mg	60–70%	Organ meats are very high in phosphorus — avoid in CKD 3–5
Evaporated milk (gatas evap)	½ cup (120 mL)	260 mg	60–70%	Avoid — used heavily in Filipino cooking; use coconut milk sparingly instead
Cow's milk / fresh milk (gatas)	1 cup (240 mL)	230 mg	60–70%	CKD 3–5: limit to ½ cup/day; dialysis: discuss with dietitian
Kidney / bato ng baboy	100 g cooked	240 mg	60–70%	Organ meats extremely high — avoid in all CKD stages
Processed cheese (keso)	1 slice (30 g)	200 mg	80–100%	Additive phosphates in processed cheese — absorbed almost completely; avoid
Monggo / mung beans (boiled)	½ cup cooked	200 mg	20–40%	Plant phytate reduces absorption; OK small portions CKD 1–3; limit CKD 4–5
Utong / bataw / black-eyed peas	½ cup cooked	180 mg	20–40%	Legumes: phytate-bound; limit in CKD 4–5; boiling leaches some phosphorus
Pili nuts / mani (peanuts)	¼ cup (30–35 g)	130–140 mg	40–60%	Limit in CKD 3+; nuts also high in potassium — double reason to restrict portions
Cola drinks (Coke, Pepsi, Royal)	1 can (330 mL)	40–50 mg*	100%	*AVOID — phosphoric acid is 100% absorbed; listed mg understates danger. Banned in CKD.
Hotdog / longganisa	1 piece (50 g)	120 mg	80–100%	Additive phosphates for color and texture — near-complete absorption; avoid
Instant noodles (Lucky Me, Payless)	1 pack	150 mg	80–100%	Phosphate additives in seasoning powder — avoid; also very high sodium
MODERATE (100–200 MG/SERVING) — USE CAREFULLY, WATCH PORTIONS				
Pork / baboy (cooked)	100 g	195 mg	50–60%	Limit portion to 60–80 g; choose lean cuts; avoid processed pork (tocino, ham)
Chicken / manok (cooked)	100 g	180 mg	50–60%	OK in CKD 1–3; limit to 60–80 g CKD 4–5; avoid fast food chicken (phosphate-injected)
Tilapia (cooked)	100 g	175 mg	50–60%	Good protein choice; limit portion; pair with rice and vegetables; take binder
Bangus / milkfish (cooked)	100 g	170 mg	50–60%	Good choice; natural phosphorus; take phosphate binder with this meal
Tofu firm (tokwa)	100 g	120 mg	30–50%	Plant phosphorus; lower absorption; good protein substitute for CKD
Egg / itlog (whole, boiled)	1 large	95 mg	50–60%	Yolk is high in phosphorus; egg whites much lower; limit to 1 whole egg/day in CKD 4–5
LOW (<100 MG/SERVING) — GENERALLY SAFE CHOICES FOR CKD				
Rice, white (kanin, cooked)	1 cup cooked	68 mg	20–30%	Safest staple carb for CKD — very low phosphorus; preferred over brown rice in CKD 4–5
Pandesal / plain bread	1 piece (50 g)	40 mg	30–40%	Plain pandesal is OK; avoid enriched or "fortified" bread with added phosphate
Kamote / sweet potato (boiled)	1 medium	50 mg	20–30%	Low phosphorus; boil and drain to also reduce potassium; good root crop for CKD
Kangkong, pechay, sayote, okra, upo	1 cup cooked	20–50 mg	20–30%	Most cooked vegetables are low phosphorus — excellent choices for all CKD stages
Cassava / kamoteng kahoy	1 cup boiled	28 mg	20–30%	Very low phosphorus; good root crop; avoid processed cassava products with additives
Gabi / taro (boiled)	1 cup cooked	40 mg	20–30%	Low phosphorus and potassium; safe for most CKD stages; traditional Filipino staple
Papaya, calamansi, apple, saging (1 pc)	1 piece / ½ cup	20–30 mg	20–30%	Fruits generally low phosphorus; watch potassium in CKD 4–5 (banana: moderate K)
Cooking oils (coconut, canola)	1 tbsp	0 mg	—	Zero phosphorus; use in normal cooking amounts
Sago / rice noodles	½ cup cooked	~5 mg	—	Nearly zero phosphorus; excellent CKD-friendly carbohydrate

Absorption % = estimated from literature; varies by food preparation, gut health, and individual factors. Boiling meat/fish and discarding water reduces phosphorus 30–55%. Always take phosphate binder WITH any moderate or high phosphorus meal. Cola/processed meats: listed mg values understate danger because additive phosphorus is 100% absorbed.

Phosphate Binders Available in the Philippines				
Binder	Brand (PHL)	Usual Dose	Take With	Key Notes for Filipino Patients
Calcium carbonate	Caltrate, generic CaCO ₃	500–1500 mg per meal	WITH meal	Most affordable; widely available; doubles as calcium supplement — but watch for hypercalcemia and vascular calcification with overuse. Avoid in patients with high calcium or calcification.
Sevelamer HCl	Renagel	800 mg 3× per day with meals	WITH meal	No calcium load — preferred in patients with vascular calcification or hypercalcemia. Also lowers LDL. More expensive; requires prescription. Swallow whole — do not crush.
Lanthanum carbonate	Fosrenol	500–1000 mg per meal	WITH meal	Chew thoroughly before swallowing — never swallow whole. Very effective. No calcium. Expensive; limited availability in provinces. Good for patients who cannot take sevelamer.
Calcium acetate	PhosLo, generic	667 mg per meal	WITH meal	Contains less elemental calcium than carbonate — lower hypercalcemia risk. Good second-line calcium-based option. Take exactly at the start of eating.
Aluminum hydroxide	Antacid generics	Short-term use only	WITH meal	Effective but aluminum accumulates in dialysis patients → neurotoxicity and bone disease. Use only for short-term rescue in severe hyperphosphatemia — not for chronic use.

Critical Timing Rule — Binders MUST Be Taken WITH Meals

Phosphate binders work by binding dietary phosphorus **inside the gut** before it is absorbed. If taken before or after eating, the food has already passed — the binder cannot reach the phosphorus. **Skipping even one meal dose allows that entire meal's phosphorus to be fully absorbed.** Take your binder at the first bite of every main meal, every day.

The Additive Phosphorus Problem — What to Look for on Labels

DANGEROUS — Avoid These Label Ingredients

- **Phosphoric acid** — cola drinks; 100% absorbed
- **Sodium phosphate** — processed meats, bread improvers
- **Potassium phosphate** — processed foods, sports drinks
- **Calcium phosphate** — fortified foods (ironic: avoid in CKD)
- **Pyrophosphate** — fast food chicken, canned tuna
- **Polyphosphate** — seafood products, processed meats
- **Triphosphate** — shrimp, canned fish

QUICK RULE: Anything with "PHOS" = Avoid

In the Philippines, ingredient labels may be in English or Filipino. Look for "PHOS" anywhere in the ingredient name — if you see it, put the product back.

Hidden sources:

"fortified" biscuits and breads, instant coffee mixes, flavored powders (Tang, Milo in excess), canned sardines in tomato sauce with preservatives, processed tocino/corned beef.

Safer choices:

plain canned sardines in water, fresh fish, plain rice, home-cooked ulam without seasoning packets.

Cooking Techniques to Reduce Phosphorus

1

Boil Meat & Fish

Boiling meat (manok, baboy) or fish (tilapia, bangus) in a large volume of water leaches 30–55% of phosphorus into the cooking water. **Discard the water — do not make soup from it.** Then cook the boiled meat in your sinigang, adobo, or ginisa.

2

Soak Legumes Overnight

Soak dried monggo, beans, or garbanzos in water overnight. Drain and rinse before cooking. This removes 20–30% of phosphorus. Then boil in fresh water (repeat boiling once for maximum reduction). The phytate also reduces absorption further.

3

Choose Fresh Over Processed

Fresh galunggong, tilapia, or bangus has natural (organic) phosphorus — partly absorbed. Processed or canned fish with preservatives has additive phosphorus — almost fully absorbed. Same logic for chicken: home-cooked > fast food (phosphate-injected).

KDIGO CKD-MBD 2017 · Kalantar-Zadeh et al., JASN 2010 · Educational use only. Binder choices must be individualized by your nephrologist.

stjohnbiocare.com · Page 4 of 6

Symptoms of Hyperphosphatemia

Warning: Hyperphosphatemia is often **silent until advanced** — many patients feel fine even with dangerously elevated phosphorus. This is why regular blood tests are essential.

When symptoms appear, they include:

- **Itching (pruritus):** severe, often worse at night — calcium-phosphorus crystals deposit in skin. Common in dialysis patients with poor phosphorus control.
- **Bone pain:** aching in hips, back, legs — renal osteodystrophy. Bones become soft and fragile.
- **Joint pain:** calcium-phosphorus crystals in joints (tumoral calcinosis).
- **Eye redness:** calcium deposits on conjunctiva — "red eye" of hyperphosphatemia.
- **Muscle weakness:** related to PTH excess pulling calcium from muscles.
- **Pathologic fractures:** spontaneous breaks with minimal trauma — late-stage renal osteodystrophy.
- **Calciphylaxis: painful skin ulcers/necrosis on abdomen, thighs — a life-threatening emergency (see red box).**

Lab Monitoring Targets

Lab Value	Target (CKD 3–5D)	Frequency
Serum phosphorus	3.5–5.5 mg/dL	Every 3 mo (dialysis: monthly)
Serum calcium	8.4–10.2 mg/dL	Every 3 months
PTH (intact)	2–9× upper normal (by stage)	Every 6–12 months
Ca × P product	<55 mg ² /dL ²	Calculate from each result
25-OH Vitamin D	>30 ng/mL	Annually
Alkaline phosphatase	Normal range	Every 12 months

Ca × P product >55: significantly increased risk of vascular calcification and calciphylaxis.
Dialysis patients: phosphorus checked before each session (HD 3× weekly).

What Your Phosphorus Number Means

- **3.5–5.5 mg/dL:** Target range — keep doing what you're doing.
- **5.5–7.0 mg/dL:** Action needed — review diet, binder timing, adjust binders.
- **>7.0 mg/dL:** Danger zone — urgent dietary review + binder adjustment. Risk of calciphylaxis rises.

⚙️ Special Situations

Dialysis Patients

- Each hemodialysis session removes only **800–1000 mg phosphorus** — a 4-hour session cannot compensate for a day of high-phosphorus eating.
- Dietary restriction AND binders BOTH remain essential even on dialysis.
- Peritoneal dialysis (CAPD) removes slightly more phosphorus continuously — but still insufficient without diet control.
- Target pre-dialysis phosphorus: 3.5–5.5 mg/dL. Check your monthly labs every visit.

Vegetarian / Vegan CKD Patients

- Plant phosphorus is bound to **phytic acid (phytate)** — absorbed only 20–40% vs 50–70% from animal sources.
- Vegetarians have naturally lower phosphorus absorption — some latitude with legumes (monggo, tofu).
- Still avoid processed vegetarian foods with phosphate additives (veggie hotdogs, processed soy products).
- Plant-based diets often associated with slower CKD progression — discuss with your nephrologist.

Children with CKD

- Phosphorus targets are **stricter** in children — needed for normal bone growth and height.
- CKD stunts growth primarily through hyperphosphatemia and PTH excess disrupting growth plate function.
- Children need individualized phosphorus targets based on age and pubertal stage.
- Dairy restriction must be carefully balanced against calcium needs for bone mineralization.
- Always refer to a pediatric nephrologist and renal dietitian.

KA (Ketoacid) Supplement Users

- KA supplements (e.g., Ketosteril) contain **calcium salts** — each tablet contributes calcium to the body.
- If also taking calcium carbonate as a phosphate binder, total calcium load may become excessive.
- **Monitor calcium-phosphorus product closely** when using both KA supplements and calcium-based binders.
- Consider switching to non-calcium binders (sevelamer) if Ca × P product is elevated.
- Do not adjust KA dose without your nephrologist's guidance.

Calciphylaxis — A Life-Threatening Emergency

Calciphylaxis (calcific uremic arteriolopathy) is a rare but devastating complication of very high calcium × phosphorus product. It causes **painful, spreading skin lesions with black/necrotic centers**, typically on the abdomen, thighs, and breasts. Mortality is up to 80%. **If you develop unexplained painful skin wounds that are not healing — go to the ER immediately.** Tell them you have CKD and are on dialysis. Early treatment with sodium thiosulfate and wound care may be life-saving. Prevention: keep Ca × P product below 55.

🍽️ Sample Low-Phosphorus Filipino Meal Day — With Binder Timing

Meal	Food	Approx P	Binder Timing
Breakfast	1 cup white rice + 1 boiled egg white (discard yolk) + 1 cup kangkong ginisa (canola oil, garlic) + water	~110 mg	Take binder at first bite if prescribed
Mid-morning	1 medium papaya or apple + plain water (no canned juice, no cola)	~15 mg	Snack: no binder needed (very small P load)
Lunch	1 cup white rice + boiled tilapia 60 g (boiled first, water discarded) + 1 cup sayote cooked + calamansi juice (unsweetened)	~175 mg	Take binder WITH first bite — ESSENTIAL
Afternoon	1 small kamote (boiled) or 1 small piece plain pandesal + water	~55 mg	Light snack: small P load — discuss with dietitian
Dinner	1 cup white rice + 60 g boiled manok (boiled first, water discarded) + 1 cup pechay cooked + gabi + water	~185 mg	Take binder WITH first bite — ESSENTIAL

Daily total: ~540 mg phosphorus (before binder action) — well within the recommended 800–1000 mg/day limit for CKD 3–4. Binders will further reduce absorption from the two main meals. Avoid cola, hotdogs, processed foods — they would add 100–300 mg of 100%-absorbed additive phosphorus to these totals.

Key Takeaways — What to Remember

The Three Non-Negotiables

- 1. **Avoid cola drinks** — phosphoric acid is 100% absorbed. Even one can raises phosphorus significantly.
- 2. **Take your binder WITH every meal** — not before, not after. First bite = binder time.
- 3. **Avoid processed meats** — hotdog, longganisa, tocino all contain additive phosphates that bypass normal absorption limits.

Safe Food Choices Summary

Best grains: white rice, plain pandesal — lowest phosphorus of all staples.

Best proteins: boiled fresh fish or chicken (discard water) — natural phosphorus, reduced by boiling.

Best vegetables: kangkong, pechay, sayote, okra, ampalaya, upo, gabi, kamote — all low phosphorus.

Best fruits: papaya, calamansi, apple — low phosphorus and generally low potassium.

The Absorption Insight

A food with 200 mg phosphorus at 40% absorption delivers only 80 mg to your blood. A cola drink with 50 mg phosphorus at 100% absorption delivers 50 mg — almost as much, from a tiny serving. **The amount on the label is not the amount that harms you — absorption percentage is what matters.** Additive phosphorus always wins this comparison, always in the wrong direction.

⚠️ What to Avoid — The Danger List

- **Cola drinks (Coke, Pepsi, Royal):** phosphoric acid — complete ban in CKD.
- **Processed meats (hotdog, longganisa, ham, tocino, corned beef):** additive phosphates.
- **Instant noodles (Lucky Me, Payless):** high phosphate in seasoning sachets.
- **Evaporated milk and processed cheese:** very high dairy phosphorus.
- **Organ meats (atay, bato):** highest phosphorus per gram of any food.
- **Fast food chicken:** phosphate-injected to stay moist — absorbed near completely.
- **Any food with "PHOS" on the label:** additive phosphate — avoid.

Emergency Warning Signs — Go to ER

- **Calciphylaxis:** painful skin lesions, black/purplish areas that don't heal — on abdomen, thighs. EMERGENCY.
- **Severe bone pain with minimal trauma:** may indicate pathologic fracture.
- **Sudden severe itching all over body** with known very high phosphorus — urgent review.
- **New eye redness** in dialysis patient with high Ca × P product.

Do not wait for your next clinic appointment if you have calciphylaxis symptoms. Mortality is 50–80% — early ER treatment is life-saving.

References: KDIGO CKD-MBD Guideline 2017 Update (Kidney Int Suppl 2017;7:1–59) · KDIGO CKD Clinical Practice Guideline 2024 · Kalantar-Zadeh K et al., "Understanding sources of dietary phosphorus in the treatment of patients with chronic kidney disease," JASN 2010 · Shinaberger CS et al., "Is controlling phosphorus by decreasing dietary protein intake beneficial or harmful in persons with CKD?" Am J Clin Nutr 2008 · Nigwekar SU et al., "Calciphylaxis," N Engl J Med 2018 · FNRI Philippine Food Composition Tables 2023.