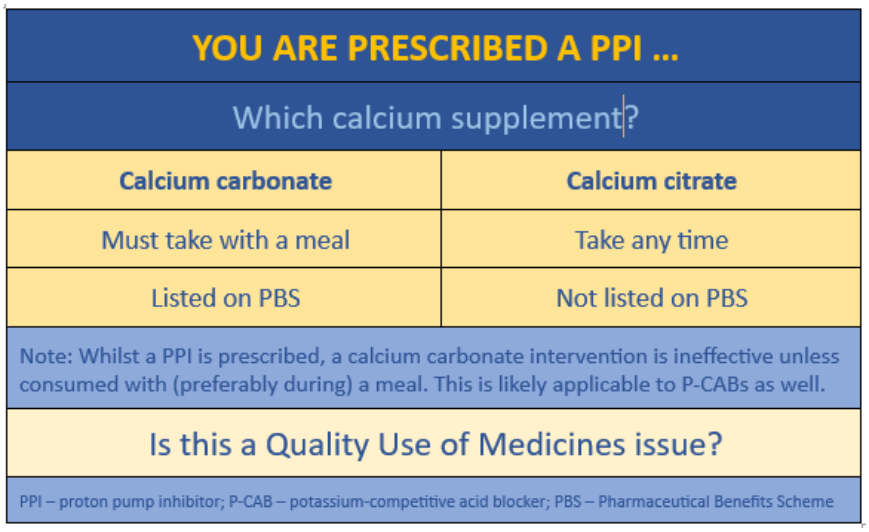
CALCIUM AND ACID INHIBITORS AND QUM



YOU ARE PRESCRIBED A PPI …	
Which calcium supplement?	
Calcium carbonate	**Calcium citrate**
Must take with a meal	Take any time
Listed on PBS	Not listed on PBS
Note: Whilst a PPI is prescribed, a calcium carbonate intervention is ineffective unless consumed with (preferably during) a meal. This is likely applicable to P-CABs as well.	
Is this a Quality Use of Medicines issue?	

PPI – proton pump inhibitor; P-CAB – potassium-competitive acid blocker; PBS – Pharmaceutical Benefits Scheme

Calcium and acid inhibitors and QUM are a seemingly unusual combination. Some acid inhibitors may reduce the effectiveness of some calcium interventions. What does this have to do with QUM (Quality Use of Medicines)?

Introduction (H3)

The therapeutic effectiveness of calcium carbonate when an acid inhibitor is also prescribed, is being questioned. Is calcium carbonate the best option? Why is it the preferred option?

Calcium (H4)

Calcium is not absorbed in the stomach it is absorbed in the intestines. *The stomach is where calcium is either converted to a soluble form such as Ca2+ or is bound to a soluble organic molecule*. This solubilization enables its intestinal absorption.

Release of calcium from its compound may require a source of acid – either gastric or dietary.

Calcium compounds and their acid requirements			
Calcium compound	**pH**	**Water soluble?**	**Is acid required?**
Ascorbate	3.5 - 4.0	Y	May be
Carbonate	1.2	N	Likely
Citrate	> 6.5	Y	No
Fumarate	6.2	Y	Unlikely
Gluconate		Y	Unlikely
Lactate		Y	Unlikely
Phosphate	2.0	N	Likely

CALCIUM AND ACID INHIBITORS AND QUM

Acid inhibitors (H4)

Acid inhibitors reduce the amount of acidity released from the gastric parietal cells into the stomach, and include -

H2 antagonists. Block the histamine receptors. Increase gastric pH to a median of about 2-3. Can maintain intragastric pH > 4 for 4 hours. Short duration of effect.

Proton pump inhibitors (PPIs). Inhibit the proton pumps. Increase gastric pH to about 4-6. Can maintain intragastric pH > 4 for 15-22 hours.

Potassium-competitive acid blockers (P-CABs). Bind to proton pumps in a K^+-competitive manner. Early evidence indicates they maintain a pH > 4 for longer than PPIs.

Comments about PPIs in this post are deemed relevant to P-CABs because of their many similarities. However, there is currently no specific evidence likely due to their recent formulation.

Quality Use of Medicines (QUM) (H4)

QUM's role is to improve medication safety and quality by reducing prescription errors and harm. Its initiatives include –

- promotion of appropriate, judicious, safe and effective medication use,

- reviewing prescription data to facilitate improvement.

Ultimately QUM is about the administration of the correct medicine, at the appropriate time, to the right person.

Calcium and acid inhibitors (H3)

A common prescription combination is calcium carbonate and a PPI. A P-CAB and calcium combination is likely to become commonplace as more is known about P-CABs. Duration of these prescription combinations is typically years not months.

PPI prescription means suppression of gastric acidity. Absorption of calcium from calcium carbonate is minimal if administered whilst fasting ie on an empty stomach. Calcium carbonate must therefore be taken at mealtimes.

Calcium from calcium citrate is not dependent on pH for absorption and therefore can be administered at any time.

Pharmaceutical Benefits Scheme (PBS) influence (H4)

The PBS is the vehicle by which the government subsidises the cost of medicine for most medical conditions.

Calcium compounds and PBS benefit			
Calcium compound	**PBS listing**	**Cost to consumer**	**Benefit**
Calcium carbonate	Yes	Minimal	Minimal, unless taken with meals

CALCIUM AND ACID INHIBITORS AND QUM

Calcium citrate	No	Pays full price	Maximal, no mealtime intrusion

Ultimately which calcium intervention is recommended seems to be based on cost to the consumer.

QUM (H4)

The cost versus benefit issue makes this a QUM matter.

Prescribers and consumers are unaware concurrent prescription of a PPI means calcium carbonate interventions are ineffective unless taken with meals.

My spot check of PPI documents found neither their Consumer Medicine Information (CMI) nor their Product Information (PI) include recommendations for calcium intervention management. This omission means -

- the right consumer is being given the right intervention likely at the wrong time; and therefore

- the taxpayer is subsidizing an ineffective intervention.

I suggest 2 strategies to address this significant QUM issue –

1. PBS listing for calcium citrate;
2. require the CMI and PI documents for PPIs to include appropriate calcium management strategies.

Currently the medicine may be correct but the timing may not be.

Clinical concerns (H3)

What actions will you initiate when you see someone prescribed both calcium carbonate and a PPI – will you -

- check that the calcium carbonate intervention is being consumed with meals?
- recommend changing to calcium citrate to ensure adequate calcium absorption?
- *contact your pharmaceutical Regulator and request appropriate calcium management strategies be included in the CMI and PI when prescribed a PPI?*

Conclusions (H3)

Calcium and acid inhibitors are a combination that will remain contentious until a relevant Regulatory Authority deems it requires addressing.

Words – 942, 919, 918, 789, 757, 742, 731

CALCIUM AND ACID INHIBITORS AND QUM

No.	Year	Reference
1	2026	https://www.safetyandquality.gov.au, search term QUM. Accessed 2026-01-26.
2	2024	Nugent, CC., Falkson, SR. & Terrell, JM. 2024. H2 blockers. Stat Pearls. BCBI Bookshelf. Accessed 2026-01-26.
3	2020	Pharmaceutical Society of Australia. 2020. Guidelines for Quality Use of Medicines (QUM) services. Pharmaceutical Society of Australia
4	2016	Beto, JA. 2015. The Role of Calcium in Human Aging. **Clinical Nutrition Research 4:**1-8. http://dx.doi.org/10.7762/cnr.2015.4.1.1
5	2023	Begg, M., Tarhuni, MN., Fotso, M., Gonzalez, NA., Sanivarapu, RR., Osman, U., Latha, KA., Sadagopan, A., Mahmoud, A. & Khan, S. 2023. Comparing the Safety and Efficacy of Proton Pump Inhibitors and Histamine-2 Receptor Antagonists in the Management of Patients With Peptic Ulcer Disease: A Systematic Review. **Cureus 15(8):**e44341. doi: 10.7759/cureus.44341. PMID: 37779765; PMCID: PMC10538946
6	2022	Anda Mihaela Naciu, AM., Giosuè Giordano Incognito, GG., Gherardo Mazziotti, G. & Palermo, A. 2022. Calcium Citrate Versus Calcium Carbonate in the Management of Chronic Hypoparathyroidism: A Randomized, Double-Blind, Crossover Clinical Trial. **Journal of Bone and Mineral Research 37(7):**1251–1259. https://doi.org/10.1002/jbmr.4564
7	2005	Drago, SR., Binaghi, MJ. & Valencia, ME. 2005. Effect of Gastric Digestion pH on Iron, Zinc, and Calcium Dialyzability from Preterm and Term Starting Infant Formulas. **Journal Of Food Science 70(2):**S107.
8		Dolinska, B., Mikulska, A., Caban, A., Ostrozka-Cieslik, A. & Ryszka, F. 2011. A model for calcium permeation into small intestine. **Biological Trace Element Research 142(3):**456-64.
9	2018	Lee, JK., Jung, SH., Lee, SE., Han, JH., Jo, E., Park, HS., Heo, KS., Kim, D., Park, JS. & Myung, CS. 2018. Alleviation of ascorbic acid-induced gastric high acidity by calcium ascorbate *in vitro* and *in vivo*. **Korean Journal of Physiology & Pharmacology 22(1):**35-42. https://doi.org/10.4196/kjpp.2018.22.1.35.
10	2024	Dickerson, B., Gonzalez, D. E., Sowinski, R., Xing, D., Leonard, M., Kendra, J., Jenkins, V., Gopalakrishnan, S., Yoo, C., Ko, J., Pillai, S. S., Bhamore, J. R., Patil, B. S., Wright, G. A., Rasmussen, C. J., & Kreider, R. B. 2024. Comparative Effectiveness of Ascorbic Acid vs. Calcium Ascorbate Ingestion on Pharmacokinetic Profiles and Immune Biomarkers in Healthy Adults: A Preliminary Study. **Nutrients 16(19):**3358. https://doi.org/10.3390/nu16193358.
11	2024	Patel, A. 2024. Calcium gluconate: more than just a supplement. https://annexechem.com/calcium-gluconate-guide/ Accessed 2026-01-28
12	2021	Nieto, JA., Soriano-Romaní, L., Tomás-Cobos, L., Sharma, L. & Budde, T. 2021. Improved in vitro bioavailability of a newly developed functionalized calcium

		carbonate salt as a food ingredient and its comparison with available commercial calcium salts. **Food Chemistry 348:**128740. https://doi.org/10.1016/j.foodchem.2020.128740.
13	2022	Shkembi, B. & Huppertz, T. 2022. Calcium Absorption from Food Products: Food Matrix Effects**. Nutrients 14(1):**180. https://doi.org/10.3390/nu14010180
14	2025	Qiao, X. & Li, P. 2025. Potassium-competitive acid blockers and advances in the management of patients with acid-related diseases: a narrative review. Frontiers in Physiology. 16:1655102. https://doi.org/10.3389/fphys.2025.1655102
15	2022	Anderson, C., Eggert, L., Fitzgerald, K., Jackson, D. & Farr, F. 2022. Calcium and phosphate solubility curve equation for determining precipitation limits in compounding parenteral nutrition. **Hospital Pharmacy 57(6):**779-785. https://doi.org/10.1177/00185787221104367.
16	2022	Wagner, M., Hess, T. & Zakowiecki, D. 2022. Studies on the pH-Dependent Solubility of Various Grades of Calcium Phosphate-based Pharmaceutical Excipients. **Journal of Pharmaceutical Sciences 111(6):**1749-1760. https://doi.org/10.1016/j.xphs.2021.12.005
17	2010	Weerapol, Y., Cheewatanakornkool, K. & Sriamornsak, P. 2010. Impact of Gastric pH and Dietary Fiber on Calcium Availability of Various Calcium Salts. **Silpakorn University Science and Technology Journal 4 (1):**15-23.