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Vitamin C, collagen and connective-tissue remodeling: evidence map

Visual deck: collagen + vitamin C protocols, dose-response data, whey/protein comparison and practical supplementation logic.

15 g
classic gelatin/collagen dose

30 g
newer dose-response signal

>=50 mg
vitamin C used in many protocols

30-60 min
timing before loading

not whey
collagen is targeted, not complete protein

Core mechanism

Vitamin C is a collagen-synthesis cofactor; collagen/gelatin supplies glycine, proline and hydroxyproline; loading directs remodeling.

Best protocol logic

Collagen/gelatin + vitamin C shortly before a short tendon-loading session, not random collagen intake without mechanical signal.

Main limitation

Markers of collagen synthesis are not the same as healed tendon. Chronic tendon trials are improving but still limited.

Sources: Shaw 2017; Lis 2019; Lee 2024; Nulty 2024/2025; Bischof 2024; Aussieker 2025; Buchalski 2026.

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Collagen-synthesis pathway: substrate + cofactor + loading

A simple mechanism diagram for the video.

Key line

“Vitamin C is necessary, but it is not a tendon-building protocol unless substrate and mechanical loading are present.”

Basic collagen biology; Baar 2017; Shaw 2017.

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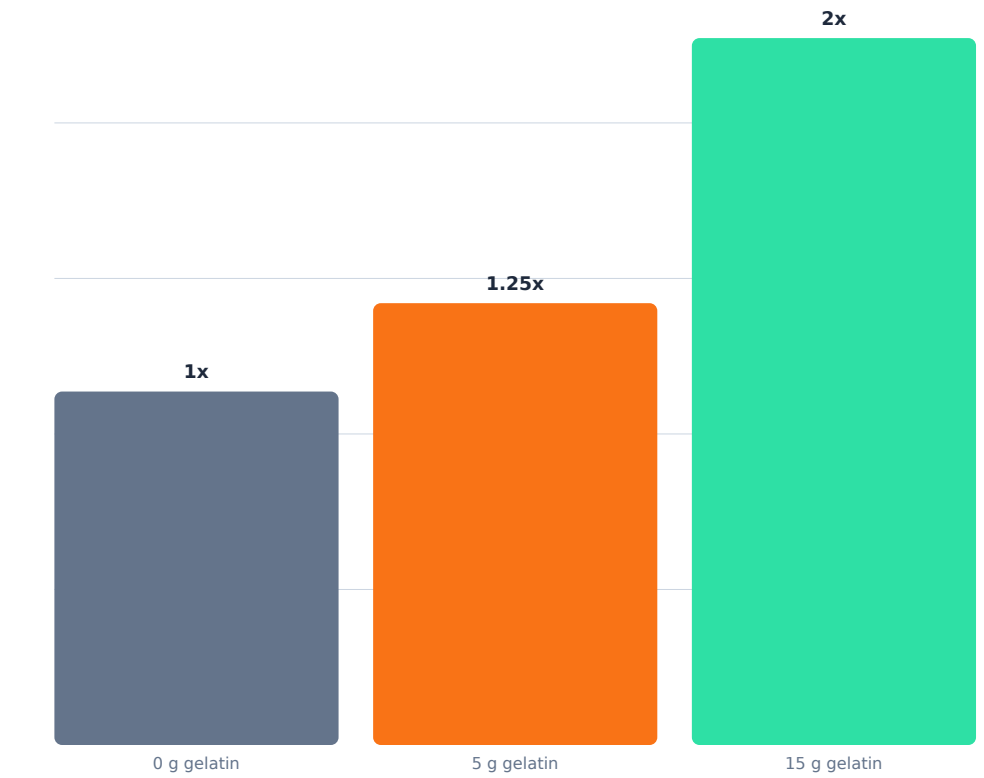
Classic acute studies: gelatin/collagen + vitamin C before exercise

These studies support the timing logic: take substrate before the mechanical signal.

Shaw 2017: simplified PINP signal



15 g group showed about double PINP signal; visual is simplified.

Study	Protocol	Takeaway
Shaw 2017	0/5/15 g gelatin + vitamin C before intermittent loading	15 g produced the strongest collagen-synthesis marker signal.
Lis 2019	Vitamin C-enriched gelatin vs hydrolyzed collagen vs gummy vs placebo	Gelatin/HC tended to increase PINP ~20%; high variability; gummy did not show same signal.

Shaw et al. 2017; Lis & Baar 2019.

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Dose response: 30 g is becoming harder to ignore

Newer studies show a greater collagen-synthesis response with 30 g hydrolyzed collagen than 15 g or 0 g before resistance exercise.

Study	Population	Dose comparison	Main result
Lee 2024	resistance-trained young men	0 vs 15 vs 30 g HC before high-intensity RE	30 g > 15 g > 0 g for whole-body collagen synthesis
Nulty 2024	resistance-trained middle-aged men	0 vs 15 vs 30 g HC before RE	15 g rescued response; 30 g was greater than 15 g and 0 g
Interpretation	athletes / rehab	15 g classic; 30 g higher signal	Clinical tendon outcome still depends on loading program

Lee et al. 2024; Nulty et al. 2024.

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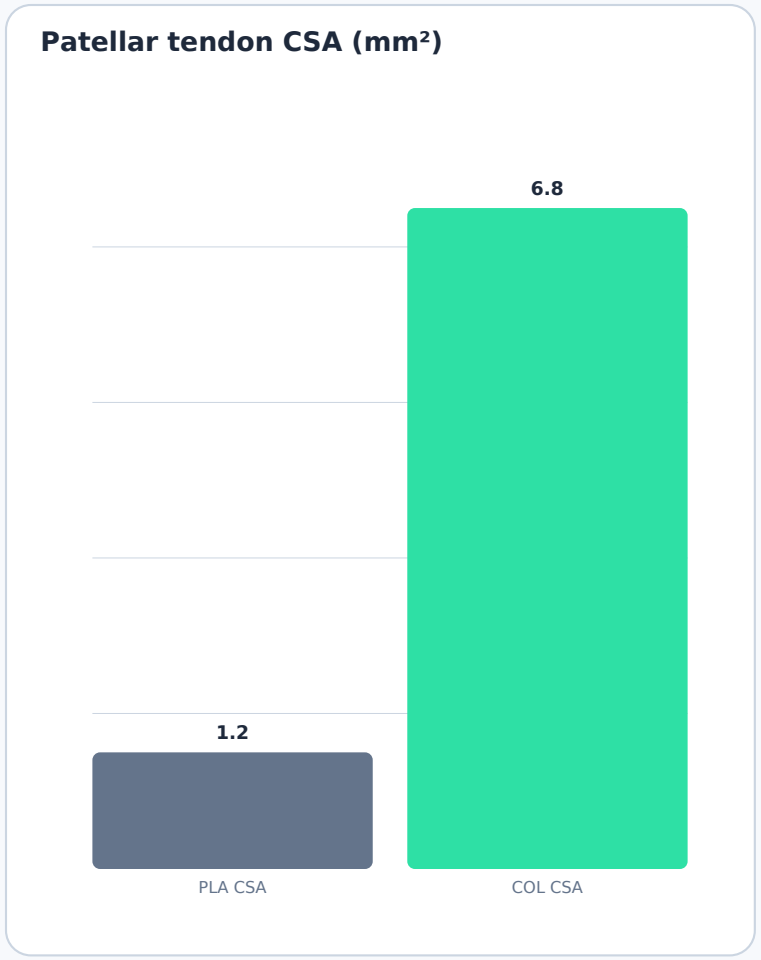
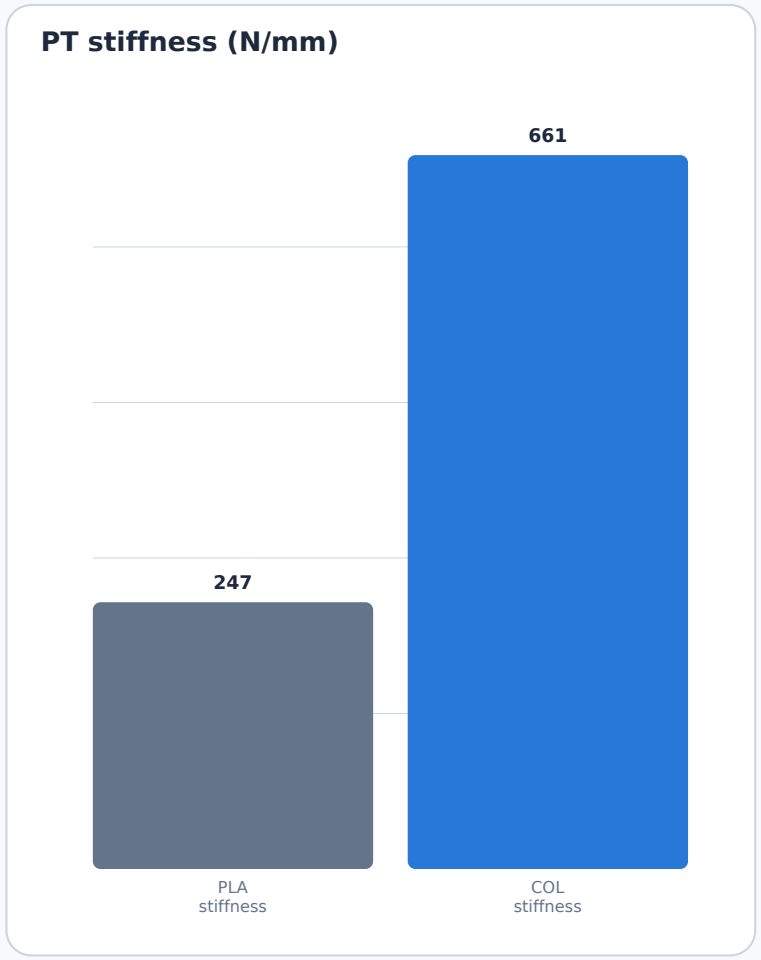
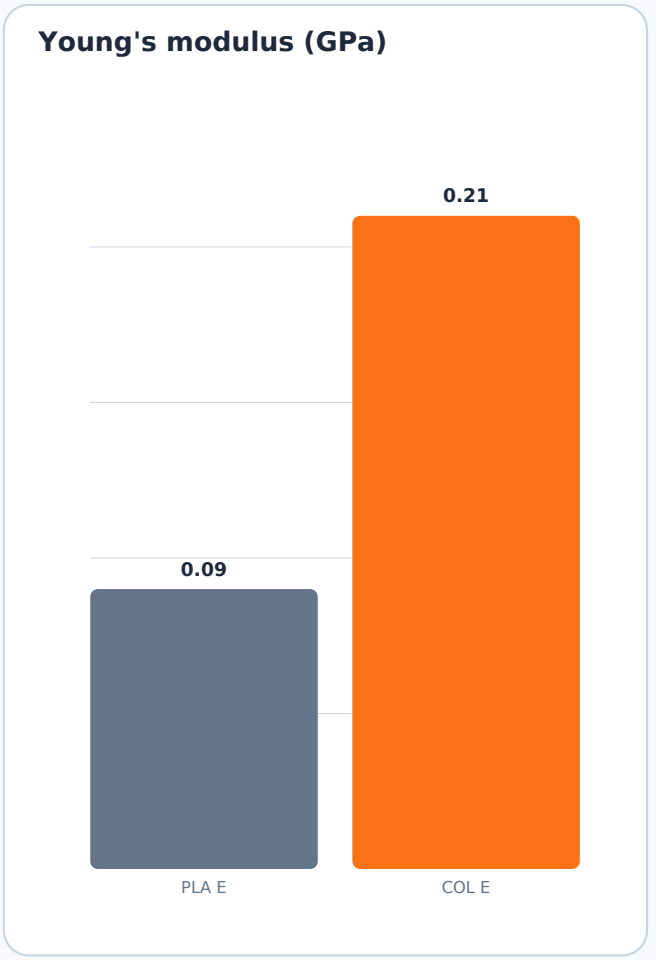
Chronic tendon trial: 30 g HC + vitamin C with resistance training

Nulty et al. 2025: 12-week resistance training in middle-aged men; collagen group vs placebo, both with vitamin C.







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Whey/protein vs collagen: not the same target

Use this slide to avoid the common mistake: collagen is not a complete muscle-building protein.

Option	Best target	Weakness	Best use
Whey / EAA	muscle protein synthesis, leucine, complete protein	low glycine/proline/hydroxyproline	daily protein and muscle hypertrophy
Whey + vitamin C	general protein + cofactor	not a tested collagen-targeted protocol	overall nutrition, not tendon-specific
Collagen/gelatin + vitamin C	connective-tissue amino acids + cofactor	poor EAA/leucine profile for muscle	targeted tendon/ligament loading sessions
Whey + collagen blend	muscle + connective protein signals	dose/context still evolving	hybrid muscle/connective-tissue strategy

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Practical supplementation algorithm

Defensible version for the video.

Goal: muscle

whey/EAA + total daily protein

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Goal: tendon loading

15-30 g collagen/gelatin + >=50 mg vitamin C

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Timing

30-60 min before targeted loading

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Loading

short tendon stimulus or heavy resistance session

Most defensible claim

“Collagen plus vitamin C may support tendon remodeling when paired with appropriate loading. It is not a standalone repair supplement.”

Shaw 2017; Lee 2024; Nulty 2024/2025; Buchalski 2026.

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Limitations and claims to avoid

Keep the video strong without overpromising.

- Do not equate PINP or whole-body collagen synthesis with healed tendon.
- Do not replace complete protein with collagen if the goal is muscle hypertrophy.
- Do not imply vitamin C megadosing is proven superior when vitamin C status is adequate.
- Do not ignore loading: collagen without mechanical signal is much weaker as a tendon story.
- Use 15 g as the classic practical dose; use 30 g as the newer higher-signal option, especially in tendon-focused blocks.

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References

Source	Main contribution
Peterkofsky 1991 / basic biochemistry	Vitamin C is required for prolyl/lysyl hydroxylation, collagen triple helix stability, secretion and cross-linking.
Shaw et al. 2017	15 g gelatin + vitamin C 1 h before intermittent loading doubled blood PINP vs lower/no gelatin and improved engineered ligament collagen signal.
Lis & Baar 2019	Vitamin C-enriched gelatin and hydrolyzed collagen tended to increase PINP ~20%; high variability; gummy did not show the same signal.
Farup et al. 2014	Whey protein hydrolysate supported tendon hypertrophy with strength training, but specificity vs collagen amino acids remains uncertain.
Khatri et al. 2021	Systematic review: collagen peptide supplementation may support body composition, collagen synthesis and joint/exercise recovery outcomes.
Lee et al. 2024	Young resistance-trained men: 30 g hydrolyzed collagen before high-intensity RE > 15 g > 0 g for whole-body collagen synthesis.
Nulty et al. 2024	Middle-aged resistance-trained men: dose-response; 15 g rescued response, 30 g greater whole-body collagen synthesis than 15 g and 0 g.
Bischof et al. 2024	Systematic review/meta-analysis: collagen peptides promising adjunct to training for musculoskeletal performance; tendon mechanisms need more data.
Aussieker et al. 2024/2025	Whey + collagen blend studies: adding collagen can preserve glycine availability and stimulate muscle connective protein synthesis at rest.
Nulty et al. 2025	12 weeks RE + 30 g HC + 50 mg vitamin C increased patellar tendon CSA, stiffness and Young modulus more than placebo.
Buchalski et al. 2026	Systematic review: 15-30 g collagen + >=50 mg vitamin C may enhance tendon remodeling with high-intensity resistance training.