A systematic appraisal of emerging alternative therapies in men's health and wellness

Yazan Qaoud[1], Maya Morcos[2], Madeleine Macdonald[2], Ahmed Shoeib[1], Yara Qureshi[1], Matthew Mak[1], Amanda Ross[1], Humberto Vigil[1], Luke Witherspoon[1]
[1]Division of Urology, Department of Surgery, The Ottawa Hospital, Ottawa, ON, Canada; [2]Faculty of Medicine, University of Ottawa, Ottawa, ON, Canada

Cite as: Qaoud Y, Morcos M, Macdonald M, et al. A systematic appraisal of emerging alternative therapies in men's health and wellness. *Can Urol Assoc J* 2025 December 15; Epub ahead of print. http://dx.doi.org/10.5489/cuaj.9368

Published online December 15, 2025

Corresponding author: Dr. Luke Witherspoon, Division of Urology, Department of Surgery, The Ottawa Hospital, Ottawa, ON, Canada; lwitherspoon@ohri.ca

***

ABSTRACT

Introduction: The use of alternative therapies for men's health continues to grow in popularity, as claims of their urologic and overall health benefits become more widespread. This study aimed to evaluate commonly purported therapies (intravenous [IV] nutrient infusions, saunas, ice baths, light therapy, and condensed nutritional supplements) in the treatment or improvement of men's urologic health.

Methods: A scoping review was conducted using the databases PubMED and SCOPUS to identify literature discussing each intervention. Outcomes of interest were urologic parameters in men aged 18 and above.

Results: Overall, the results were often conflicting or inconclusive. IV therapy lacked any supportive evidence for the claims regarding its benefits in erectile dysfunction, sperm quality, or testosterone enhancement. Sauna had mixed outcomes, with some temporary increases in testosterone and reversible adverse effects on sperm parameters. Similarly, cold water immersion showed inconsistent benefits for testosterone, with improvements in fatigue and soreness. Light therapy showed non-significant changes in hormone levels, while improvements in sexual satisfaction and hair regrowth were noted. While some herbal products showed benefits for sexual function, testosterone levels, and sperm quality, others had negligible or inconsistent outcomes.

KEY MESSAGES

- Our study assessed the available scientific evidence on 5 alternative therapies in the treatment or improvement of men's urologic health.
- Overall, the results were often conflicting or inconclusive
- The available literature is heterogenous, and studies suffer from small sample sizes, poor blinding, and reliance on surrogate endpoints, limiting generalizability.

Conclusions: There is a discordance between media claims and scientific literature regarding the impact of alternative therapies for men's health. This data is significantly limited by small sample sizes and a lack of long-term followup. There is a need for larger-scale trials to better inform patient counseling.

INTRODUCTION

Complementary and alternative medicines (CAM) have been increasingly popular since the late 1970s.[1,2] Studies show that women are more likely to report using CAM (AOR=1.49; 95% CI [1.35, 1.65]) compared to men.[3] Nevertheless, CAM use among men is rampant. In Canada, a survey of men with prostate cancer showed that 29.8% had used CAM for their cancer care, with no association to education, income, or geographic location.[4]

The surge of various health and wellness interventions claiming to improve men's health is evident in day-to-day practice. Urologists regularly encounter questions from patients about various alternative "wellness" therapies and their impact on men's health, including testosterone levels, erectile function, and fertility. There is an overwhelming number of different commercial therapies with no readily available scientifically based resource that urologists can use to counsel patients. To address these questions, we searched popular media platforms for the most common *'men's health therapies'* being advertised. Five commonly published therapies were identified, including intravenous (IV) nutrient therapy, saunas, ice baths/ cold water immersion (CWI), light therapy, and nutritional supplements. These have been heavily promoted to enhance energy, testosterone levels, erectile dysfunction (ED), sperm quality, hair loss, and prostate health.

The objective of this study is, therefore, pragmatic: to equip urologists with an evidence-based reference guide that can be utilized to counsel patients on these popular interventions. While some interventions have theoretical rationale, exaggerated claims and potential misinformation may lead to inappropriate self-treatment and harm. It is critical to assess whether these popular strategies are scientifically validated in the context of men's health. Our goal is to bridge the gap between popular claims and available scientific evidence, to better guide clinicians and patients.

METHODS

Search strategy

The interventions assessed in this study were selected based on a combination of our review of non-scientific general media publications, and clinical experience with patient concerns and questions. Five commonly advertised therapies were identified including IV nutrient therapy, sauna, ice baths/CWI, light therapy, and nutritional supplements. This scoping review followed the Preferred Reporting Items for Systematic reviews and Meta-Analysis (PRISMA) extension for scoping review framework.

PubMED and SCOPUS were searched for English articles from inception to November 2024 using various keywords in combination (Appendix A). Two reviewers screened and synthesized data, with disagreements resolved by a third reviewer.

Study design criteria
Included studies were randomized controlled trials (RCTs), non-randomized trials, cohort studies, and observational studies, published in English.

Study participants and intervention criteria
Eligible studies included male participants aged 18+ and assessed six commonly reported men's health outcomes that appeared frequently in our media search (testosterone levels, ED, spermatogenesis, infertility, alopecia, and prostate health)

RESULTS

IV nutrient therapy
IV nutrient therapy encompasses the administration of nutrients, vitamins, or minerals through an intravenous route for various claimed health benefits. It is usually offered at private clinics, medical spas, or even through mobile IV therapy services. Ingredients in the therapies are not always tailored to individual deficiencies and the operating clinics and services are usually within a profit-driven or private healthcare model. The popular urologic benefit claims for IV therapy include correcting ED/hypogonadism, improving sperm quality, and enhancing libido.[5,6]

Of the 709 screened studies we identified and screened, six made it past primary screening, but none were included following secondary screening (supplementary figure 1). There were no studies available in the literature that supported any of the media claims surrounding IV therapy. This demonstrates an apparent disconnect between what is being marketed and what is being rigorously studied.

Sauna
Sauna is purported to improve ED through cardiovascular benefits, counter depression and promote hair growth.[7–10]

We identified a total of 13 studies that met eligibility, most of which were small, non-randomized trials (supplementary figure 2). Overall, the findings from these studies on sauna use are mixed. Two studies reported transient increases in testosterone levels (small sample sizes, n=8) following a sauna session,[11,12] yet this effect was not consistent and often quickly reversible.[13–16] More critically, several studies consistently identified detrimental effects of sauna use on spermatogenesis, motility, and sperm morphology, suggesting a net reproductive risk. However, the negative impact on sperm parameters was reversible with a return to normal values after 10-12 weeks from sauna exposure.[15,18–20] Although many of these studies were experimental, non-randomized trials with low sample sizes, the observed negative effects of sauna on spermatogenesis warrant caution, particularly in young men considering work-up and treatment for infertility.

Cold water immersion (CWI) therapy
CWI is often promoted for boosting testosterone levels, enhancing recovery, and improving overall mood.[21,22]

We included in our final analysis six studies, all of which were RCTs, assessing CWI (supplementary figure 3). All six studies evaluating CWI, which was typically administered following an exercise intervention, failed to demonstrate any significant testosterone elevation, with some studies showing evidence of decline in levels, raising concerns that CWI may blunt

anabolic responses.[23–28] Nevertheless, several studies reported improved subjective recovery markers.[23,24,26] For example, Halson et al demonstrated reduced fatigue (5.3 vs. 6.3), soreness (3.8 vs. 5.0), and enhanced mental recovery (6.7 vs. 6.1) with CWI.[23] Therefore, while CWI may help with recovery post-exercise, the claims regarding testosterone lack scientific support.

Light therapy

Light therapy is promoted for its effect on improving libido, testosterone levels, hair growth, and overall mood, as well as reducing lactic acid accumulation. [29-33] Our review included two meta-analyses, three RCTs, and one observational cohort study discussing light therapy (supplementary figure 4).

There is no evidence to support claims regarding a reduction in the levels of inflammatory markers. [34] Most studies showed non-significant or marginal changes in testosterone levels following light therapy. Interestingly, Parikh et al. suggested there may be seasonal testosterone changes with natural light exposure, but these were not directly tied to therapeutic light devices.[36] Nevertheless, several studies showed improved self-reported sexual satisfaction and PLS scale scores after light therapy with ultraviolet B radiation exposure, suggesting benefits for libido and sexual well-being.[35-36] For androgenetic alopecia, low-level laser therapy (LLLT) showed promising results, with the meta-analysis by Adil and Godwin[38] reporting a significant increase in hair density (+17.66 hairs/cm²), and the meta-analysis by Perez et al.[39] confirming these findings across eight RCTs, with a pooled effect size of 1.32 (95% CI: 0.93–1.71; $p = 0.000$). This remains one of the few domains in our review where evidence supports popular claims.

Condensed nutritional supplement

Nutritional supplements were the most diverse category in this study, with heterogeneous study designs and outcomes. We have reported on some of the most commonly discussed supplements, although a full review of every nutritional supplement is beyond the scope of this review. Overall, the evidence was mixed and often limited by small sample sizes, short study durations, and inconsistent outcomes. Refer to the PRISMA diagram in supplementary figure 5.

Caffeine

Claimed to improve sexual function and lower rates of ED.[40] One cross-sectional study (n = 3,724) suggested reduced incidence of ED with moderate caffeine intake, but pooled data from two large meta-analyses found no causal association.[41-43] Its effects on testosterone levels are mixed, with contradictory results from two different RCTs. [44,45]

Androstenedione: Claimed to increase muscle mass and testosterone levels. [46] RCTs demonstrate conflicting evidence on the impact on testosterone levels, with overall inconsistent results. Long-term safety concerns (e.g. secondary conversion to estrogen, testicular atrophy, impotence) remain unaddressed.[49–51]

Vitamin D

Claimed to improve testosterone levels, ED, and fertility.[52] Conflicting evidence exists for vitamin D supplementation as well, however, there may be an observed benefit on testosterone levels, IIEF-5 scores, and sperm parameters in patients with coexistent vitamin D deficiency.[53-57]

Fenugreek, Ashwagandha, Mucuna Pruriens, and Eurycoma Longifolia: Herbal supplements claimed to have benefits on testosterone levels, various sperm parameters, ED, and

overall sexual function.[58-61] Studies on these herbal supplements showed potential benefits for boosting testosterone levels, sperm quality, and sexual function. However, the extent of the benefit varied across studies, which were limited by small sample sizes and a lack of long-term follow-up. Therefore, the clinical significance of this net benefit is yet to be determined, with ambiguity regarding long-term safety.[62–73]

D-Aspartic Acid, Creatine, and L-Arginine

All three are claimed to have benefits such as boosting testosterone levels, sexual function, muscle strength, and reducing fatigue.[74-76] Overall, from our included studies on D-Aspartic acid and creatine, no clear benefit towards elevating testosterone was established.[77-80] Conversely, there is some evidence (1 RCT,n=108) that L-arginine supplementation may improve IIEF-5 scores and total testosterone levels in combination with Tadalafil in diabetic patients with ED.[81]

Minerals

We reviewed magnesium, calcium, and zinc, which have various different claims surrounding their benefits in popular media, including improving testosterone levels, bone strength, exercise recovery, ED, infertility, prostate health, and sperm count, amongst others.[82-84] In terms of our outcomes of interest, many of the studies yielded inconclusive findings, particularly in the context of several confounders like baseline deficiencies and activity levels.[85-87] Therefore, it is not possible to draw clinical conclusions based on the current literature.

Limitations

This review is subject to several limitations. The significant heterogeneity in interventions, study designs, populations, and outcomes prevented direct comparisons or a meta-analysis. Additionally, many studies, although a large majority were RCTs, contained small sample sizes, lacked blinding, and relied on surrogate endpoints rather than clinically meaningful outcomes, limiting generalizability. Lastly, our focus on urologic outcomes may have excluded broader effects that could still influence overall supplement usage and health perceptions. Nonetheless, this review offers a comprehensive summary of the available evidence, or lack thereof, behind widely marketed supplements.

CONCLUSIONS

CAM has grown in popularity over the last two decades, with many seeking it for preventative health strategies and to maintain a healthy lifestyle. At least a third of American adults have used CAM in the past.[88] In Canada, 80% of Canadians have used CAM at some point in their lives, with the majority of respondents reporting doing so to improve "wellness" and maintain health and vitality.[89] Our study highlights a significant disconnect between the health claims propagated through popular platforms and the evidence base available in peer-reviewed literature, particularly in urologic domains such as testosterone regulation, erectile function, fertility, and sexual health. While some interventions like light therapy show promise, others, including IV therapy, ice baths, sauna, and several nutritional supplements, lack concrete evidence. Many studies suffer from small sample sizes, poor blinding, and reliance on surrogate endpoints, limiting generalizability. Large-scale, high-quality randomized controlled trials are needed to align consumer expectations and clinical reality. This paper should serve as a reference for urologists to discuss with patients presenting with questions surrounding these treatments to

indicate that little to no data exists for a majority of them at this time, despite what our patients may be presented with via typical media outlets.

REFERENCES

1. Eisenberg DM, Davis RB, Ettner SL, et al. Trends in alternative medicine use in the United States, 1990-1997: results of a follow-up national survey. *JAMA* 1998;280:1569-75. https://doi.org/10.1001/jama.280.18.1569
2. Tindle HA, Davis RB, Phillips RS. Trends in use of complementary and alternative medicine by US adults: 1997-2002. *Altern Ther Health Med* 2005;11:42-9.
3. Alwhaibi M, Sambamoorthi U. Gender differences in the use of complementary and alternative medicine among adults with multiple chronic conditions. *Value Health* 2015;18:A90-1. https://doi.org/10.1016/j.jval.2015.03.530
4. Boon H, Westlake K, Stewart M, et al. Use of complementary/alternative medicine by men diagnosed with prostate cancer: prevalence and characteristics. *Urology* 2003;62:849-53. https://doi.org/10.1016/S0090-4295(03)00668-X
5. Can IV therapy boost libido?: Men's T Clinic®: Testosterone replacement. Available at: https://www.menstclinic.com/blog/can-iv-therapy-boost-libido (accessed May 5, 2025)
6. Four ways IV therapy can support your fertility. The Clara Clinic. June 12, 2023. Available at: https://theclaraclinic.com/blog-home/4-ways-iv-therapy-can-support-your-fertility (accessed May 5, 2025)
7. How traditional saunas can naturally promote hair growth and prevent hair loss. Nosta Sauna. April 4, 2023. https://nostasauna.com/blog/prevents-hair-loss-and-promotes-growth/ (accessed May 5, 2025)
8. McVean A. Facts and myths of male fertility: Tight underwear, hot tubs, marijuana, and more. Office for Science and Society. September 2, 2020. Accessed May 5, 2025. https://www.mcgill.ca/oss/article/health/facts-and-myths-male-fertility-tight-underwear-hot-tubs-marijuana-and-more
9. Using a sauna for erectile dysfunction: A promising strategy. Clearlight® Saunas. June 10, 2024. https://www.infraredsauna.co.uk/blog/sauna-for-erectile-dysfunction (accessed May 5, 2025)
10. Borst H. 5 science-backed sauna benefits for your mind and body. Forbes Health. January 23, 2024. Available at: https://www.forbes.com/health/wellness/sauna-benefits/ (accessed May 5, 2025)
11. Opaszowski BH, Buśko K, Błachnio D. Effect of rehydration on hormonal responses to heat exposure in a Finnish sauna bath. *Biol Sport* 2001;18:193-208.
12. Kukkonen-Harjula K, Oja P, Laustiola K, et al. Hemodynamic and hormonal responses to heat exposure in a Finnish sauna bath. *Eur J Appl Physiol* 1989;58:543-50. https://doi.org/10.1007/BF02330710
13. Rissanen JA, Häkkinen A, Laukkanen J, et al. Acute neuromuscular and hormonal responses to different exercise loadings followed by a sauna. *J Strength Cond Res* 2020;34:313-22. https://doi.org/10.1519/JSC.0000000000003371
14. Leppäluoto J, Huttunen P, Hirvonen J, et al. Endocrine effects of repeated sauna bathing. *Acta Physiol Scand* 1986;128:467-70. https://doi.org/10.1111/j.1748-1716.1986.tb08000.x
15. Garolla A, Torino M, Sartini B, et al. Seminal and molecular evidence that sauna exposure affects human spermatogenesis. *Hum Reprod* 2013;28:877-85. https://doi.org/10.1093/humrep/det020

16. Podstawski R, Borysławski K, Pomianowski A, et al. Endocrine effects of repeated hot thermal stress and cold water immersion in young adult men. *Am J Mens Health* 2021;15:15579883211008339. https://doi.org/10.1177/15579883211008339
17. Jockenhövel F, Gräwe A, Nieschlag E. A portable digital data recorder for long-term monitoring of scrotal temperatures. *Fertil Steril* 1990;54:694-700. https://doi.org/10.1016/S0015-0282(16)53832-1
18. Saikhun J, Kitiyanant Y, Vanadurongwan V, et al. Effects of sauna on sperm movement characteristics of normal men measured by computer-assisted sperm analysis. *Int J Androl* 1998;21:358-63. https://doi.org/10.1046/j.1365-2605.1998.00138.x
19. Garolla A, Šabović I, Tescari S, et al. Impaired sperm function in infertile men relies on the membrane sterol pattern. *Andrology* 2018;6:325-34. https://doi.org/10.1111/andr.12468
20. Brown-Woodman PD, Post EJ, Gass GC, et al. The effect of a single sauna exposure on spermatozoa. *Arch Androl* 1984;12:9-15. https://doi.org/10.3109/01485018409161141
21. Lindberg S. Ice bath benefits: Research, tips, and more. Healthline. April 9, 2019. Available at: https://www.healthline.com/health/exercise-fitness/ice-bath-benefits (accessed May 5, 2025)
22. Dessent-Jackson L. How to boost your testosterone levels with cold therapy. Men's Health. November 7, 2019. Available at: https://www.menshealth.com/uk/health/a29721412/testosterone-cold-therapy/ (accessed May 5, 2025)
23. Halson SL, Quod MJ, Martin DT, et al. Physiological responses to cold water immersion following cycling in the heat. *Int J Sports Physiol Perform* 2008;3:331-46. https://doi.org/10.1123/ijspp.3.3.331
24. Tabben M, Ihsan M, Ghoul N, et al. Cold water immersion enhanced athletes' wellness and 10-m short sprint performance 24-h after a simulated mixed martial arts combat. *Front Physiol* 2018;9:1542. https://doi.org/10.3389/fphys.2018.01542
25. De Freitas VH, Ramos SP, Bara-Filho MG, et al. Effect of cold water immersion performed on successive days on physical performance, muscle damage, and inflammatory, hormonal, and oxidative stress markers in volleyball players. J *Strength Cond Res* 2019;33:502-13. https://doi.org/10.1519/JSC.0000000000001884
26. Schimpchen J, Wagner M, Ferrauti A, et al. Can cold water immersion enhance recovery in elite olympic weightlifters? An individualized perspective. *J Strength Cond Res* 2017;31:1569-76. https://doi.org/10.1519/JSC.0000000000001591
27. Earp JE, Hatfield DL, Sherman A, et al. Cold-water immersion blunts and delays increases in circulating testosterone and cytokines post-resistance exercise. *Eur J Appl Physiol* 2019;119:1901-7. https://doi.org/10.1007/s00421-019-04178-7
28. Ahokas EK, Ihalainen JK, Kyröläinen H, et al. Effects of water immersion methods on postexercise recovery of physical and mental performance. *J Strength Cond Res* 2019;33:1488-95. https://doi.org/10.1519/JSC.0000000000003134
29. Red light therapy for testosterone. Infraredi. Available at: https://infraredi.com.au/blogs/red-light-therapy/red-light-therapy-for-testosterone (accessed May 5, 2025)
30. Greenfield B. I Put a giant red light on my balls to triple my testosterone levels. Men's Health. October 26, 2017. Available at:

https://www.menshealth.com/health/a19539973/i-put-a-giant-red-light-on-my-balls-to-triple-my-testosterone-levels/ (accessed May 5, 2025)
31. Why led light therapy is ideal for men. The Light Salon. Available at: https://www.thelight-salon.com/blogs/led-journal/why-led-light-therapy-is-ideal-for-men (accessed May 5, 2025)
32. What is LED therapy? Victory Men's Health. Available at: https://www.victorymenshealth.com/red-light-therapy/ (accessed May 5, 2025)
33. Corliss J. Light therapy: Not just for seasonal depression? Harvard Health. October 28, 2022. Available at: https://www.health.harvard.edu/blog/light-therapy-not-just-for-seasonal-depression-202210282840 (accessed May 5, 2025)
34. Zagatto AM, Dutra YM, Lira FS, et al. Full body photobiomodulation therapy to induce faster muscle recovery in water polo athletes: Preliminary results. *Photobiomodul Photomed Laser Surg* 2020;38:766-72. https://doi.org/10.1089/photob.2020.4803
35. Bossini L, Caterini C, Koukouna D, et al. Light therapy as a treatment for sexual dysfunctions - Beyond a pilot study. *Psychiatr Pol* 2013;47:1113-22. https://doi.org/10.12740/PP/20379
36. Parikh R, Sorek E, Parikh S, et al. Skin exposure to UVB light induces a skin-brain-gonad axis and sexual behavior. *Cell Rep* 2021;36:109579. https://doi.org/10.1016/j.celrep.2021.109579
37. Grandner MA, Kripke DF, Elliott J, et al. Short wavelength light administered just prior to waking: A pilot study. *Biol Rhythm Res* 2013;44:13-32. https://doi.org/10.1080/09291016.2011.632578
38. Adil A, Godwin M. The effectiveness of treatments for androgenetic alopecia: A systematic review and meta-analysis. *J Am Acad Dermatol* 2017;77:136-41.e5. https://doi.org/10.1016/j.jaad.2017.02.054
39. Perez SM, Vattigunta M, Kelly C, et al. Low-level laser and LED therapy in alopecia: A systematic review and meta-analysis. *Dermatol Surg* 2025;51:179-83. https://doi.org/10.1097/DSS.0000000000004442
40. Can caffeine impact men's sexual health? UPMC HealthBeat. September 17, 2021. Available at: https://share.upmc.com/2021/09/caffeine-impact-mens-sexual-health/ (accessed May 5, 2025)
41. Lopez DS, Wang R, Tsilidis KK, et al. Role of caffeine intake on erectile dysfunction in US men: Results from NHANES 2001-2004. *PLoS One* 2014;10:e0123547. https://doi.org/10.1371/journal.pone.0123547
42. Karimi M, Asbaghi O, Kazemi K, et al. Association between caffeine intake and erectile dysfunction: a meta-analysis of cohort studies. *J Health Popul Nutr* 2024;43:154. https://doi.org/10.1186/s41043-024-00645-w
43. Xiang N, Hu Y, Peng W, et al. Potential genetic association between coffee/caffeine consumption and erectile dysfunction: A Mendelian randomization study and meta-analysis. *Front Endocrinol Lausanne* 2024;15:1400491. https://doi.org/10.3389/fendo.2024.1400491
44. Beaven CM, Hopkins WG, Hansen KT, et al. Dose effect of caffeine on testosterone and cortisol responses to resistance exercise. *Int J Sport Nutr Exerc Metab* 2008;18:131-41. https://doi.org/10.1123/ijsnem.18.2.131

45. Wu BH, Lin JC. Caffeine attenuates acute growth hormone response to a single bout of resistance exercise. *J Sports Sci Med* 2010;9:262-269.
46. Reinberg S. The side effects of 'Andro,' the banned supplement androstenedione piedmont orthopedics. OrthoAtlanta. Edreamz Echo Demo. February 3, 2023. Available at: https://www.orthoatlanta.com/health-news/the-side-effects-of-andro-the-banned-supplement-androstenedione (accessed May 5, 2025)
47. Judge LW, Bellar DM, Hoover DL, et al. Effects of acute androstenedione supplementation on testosterone levels in older men. *Aging Male* 2016;19:161-7. https://doi.org/10.3109/13685538.2016.1167180
48. Leder BZ, Longcope C, Catlin DH, et al. Oral androstenedione administration and serum testosterone concentrations in young men. *JAMA* 2000;283:779-82. https://doi.org/10.1001/jama.283.6.779
49. Brown GA, Vukovich MD, Martini ER, et al. Endocrine and lipid responses to chronic androstenediol-herbal supplementation in 30- to 58-year-old men. *J Am Coll Nutr* 2001;20:520-8. https://doi.org/10.1080/07315724.2001.10719061
50. Brown GA, Vukovich MD, Martini ER, et al. Effects of androstenedione-herbal supplementation on serum sex hormone concentrations in 30- to 59-year-old men. *Int J Vitam Nutr Res* 2001;71:293-301. https://doi.org/10.1024/0300-9831.71.5.293
51. Ballantyne CS, Phillips SM, MacDonald JR, et al. The acute effects of androstenedione supplementation in healthy young males. *Can J Appl Physiol* 2000;25:68-78. https://doi.org/10.1139/h00-005
52. Wisner W. 7 benefits of vitamin D for men. The Checkup. November 21, 2022. Available at: https://www.singlecare.com/blog/vitamin-d-benefits-for-men/ (accessed May 5, 2025)
53. Maghsoumi-Norouzabad L, Zare Javid A, Mansoori A, et al. The effects of vitamin D3 supplementation on spermatogram and endocrine factors in asthenozoospermia infertile men: A randomized, triple-blind, placebo-controlled clinical trial. *Reprod Biol Endocrinol* 2021;19:102. https://doi.org/10.1186/s12958-021-00789-y
54. Canguven O, Talib RA, El Ansari W, et al. Vitamin D treatment improves levels of sexual hormones, metabolic parameters and erectile function in middle-aged vitamin D deficient men. *Aging Male* 2017;20:9-16. https://doi.org/10.1080/13685538.2016.1271783
55. Nimptsch K, Platz EA, Willett WC, et al. Association between plasma 25-OH vitamin D and testosterone levels in men. *Clin Endocrinol Oxf* 2012;77:106-12. https://doi.org/10.1111/j.1365-2265.2012.04332.x
56. Michalczyk MM, Gołaś A, Maszczyk A, et al. Influence of sunlight and oral D3 supplementation on serum 25(Oh)d concentration and exercise performance in elite soccer players. *Nutrients* 2020;12. https://doi.org/10.3390/nu12051311
57. Mielgo-Ayuso J, Calleja-González J, Urdampilleta A, et al. Effects of vitamin D supplementation on hematological values and muscle recovery in elite male traditional rowers. *Nutrients* 2018;10. https://doi.org/10.3390/nu10121968
58. Blumberg P. The health benefits of fenugreek, according to dietitians. Men's Health. November 25, 2023. Available at: https://www.menshealth.com/nutrition/a45896536/fenugreek-health-benefits/ (accessed May 5, 2025)

59. Hayes A, Neudecker K. Why ashwagandha may be the stress buster you are after. Men's Health. January 20, 2025. Available at: https://www.menshealth.com/uk/health/a31147772/ashwagandha-benefits/ (accessed May 5, 2025)
60. Lubeck B. Mucuna Pruriens: Health benefits vs. safety risks. Verywell Health. September 20, 2024. Available at: https://www.verywellhealth.com/mucuna-pruriens-7642782 (accessed May 5, 2025)
61. Garza E. Tongkat ali benefits for males. Hims. June 10, 2024. Available at: https://www.hims.com/blog/tongkat-ali-benefits-sexually (accessed May 5, 2025)
62. Rao A, Steels E, Inder WJ, et al. Testofen, a specialized Trigonella foenum-graecum seed extract reduces age-related symptoms of androgen decrease, increases testosterone levels and improves sexual function in healthy aging males in a double-blind randomized clinical study. *Aging Male* 2016;19:134-42. https://doi.org/10.3109/13685538.2015.1135323
63. Steels E, Rao A, Vitetta L. Physiological aspects of male libido enhanced by standardized Trigonella foenum-graecum extract and mineral formulation. *Phytother Res* 2011;25:1294-1300. https://doi.org/10.1002/ptr.3360
64. Maheshwari A, Verma N, Swaroop A, et al. Efficacy of furosap(TM), a novel Trigonella foenum-graecum seed extract, in enhancing testosterone level and improving sperm profile in male volunteers. *Int J Med Sci* 2017;14:58-66. https://doi.org/10.7150/ijms.17256
65. Ahmad MK, Mahdi AA, Shukla KK, et al. Withania somnifera improves semen quality by regulating reproductive hormone levels and oxidative stress in seminal plasma of infertile males. *Fertil Steril* 2010;94:989-96. https://doi.org/10.1016/j.fertnstert.2009.04.046
66. Ambiye VR, Langade D, Dongre S, et al. Clinical evaluation of the spermatogenic activity of the root extract of ashwagandha (Withania somnifera) in oligospermic males: A pilot study. *Evid Based Complement Altern Med* 2013;2013:571420. https://doi.org/10.1155/2013/571420
67. Ahmad MK, Mahdi AA, Shukla KK, et al. Effect of Mucuna pruriens on semen profile and biochemical parameters in seminal plasma of infertile men. *Fertil Steril* 2008;90:627-35. https://doi.org/10.1016/j.fertnstert.2007.07.1314
68. Shukla KK, Mahdi AA, Ahmad MK, et al. Mucuna pruriens improves male fertility by its action on the hypothalamus-pituitary-gonadal axis. *Fertil Steril* 2009;92:1934-40. https://doi.org/10.1016/j.fertnstert.2008.09.045
69. Ismail SB, Wan Mohammad WM, George A, et al. Randomized clinical trial on the use of PHYSTA freeze-dried water extract of eurycoma longifolia for the improvement of quality of life and sexual well-being in men. *Evid Based Complement Altern Med* 2012;2012:429268. https://doi.org/10.1155/2012/429268
70. Udani JK, George AA, Musthapa M, et al. Effects of a proprietary freeze-dried water extract of eurycoma longifolia (Physta) and polygonum minus on sexual performance and well-being in men: A randomized, double-blind, placebo-controlled study. *Evid Based Complement Altern Med* 2014;2014:179529. https://doi.org/10.1155/2014/179529
71. Tambi MI, Imran MK. Eurycoma longifolia Jack in managing idiopathic male infertility. *Asian J Androl* 2010;12:376-80. https://doi.org/10.1038/aja.2010.7

72. Tambi MI, Imran MK, Henkel RR. Standardised water-soluble extract of Eurycoma longifolia, Tongkat ali, as testosterone booster for managing men with late-onset hypogonadism? *Andrologia* 2012;44 Suppl 1:226-30. https://doi.org/10.1111/j.1439-0272.2011.01168.x
73. Henkel RR, Wang R, Bassett SH, et al. Tongkat Ali as a potential herbal supplement for physically active male and female seniors: A pilot study. *Phytother Res* 2014;28:544-50. https://doi.org/10.1002/ptr.5017
74. Tinsley G. D-aspartic acid: Does it boost testosterone? Healthline. January 3, 2018. Available at: https://www.healthline.com/nutrition/d-aspartic-acid-and-testosterone (accessed May 5, 2025)
75. Does creatine cause erectile dysfunction? Oxford Online Pharmacy. September 26, 2024. Available at: https://www.oxfordonlinepharmacy.co.uk/blog/does-creatine-cause-erectile-dysfunction (accessed May 5, 2025)
76. Sherrif A. A complete guide to L-arginine for erections. Numan. Available at: https://www.numan.com/erectile-dysfunction/treatment/complete-guide-to-l-arginine-for-erections (accessed May 5, 2025)
77. Crewther B, Witek K, Draga P, et al. Short-term d-aspartic acid supplementation does not affect serum biomarkers associated with the hypothalamic-pituitary-gonadal axis in male climbers. *Int J Sport Nutr Exerc Metab* 2019;29:259-64. https://doi.org/10.1123/ijsnem.2018-0076
78. Topo E, Soricelli A, D'Aniello A, et al. The role and molecular mechanism of D-aspartic acid in the release and synthesis of LH and testosterone in humans and rats. *Reprod Biol Endocrinol* 2009;7:120. https://doi.org/10.1186/1477-7827-7-120
79. Hoffman J, Ratamess N, Kang J, et al. Effect of creatine and beta-alanine supplementation on performance and endocrine responses in strength/power athletes. *Int J Sport Nutr Exerc Metab* 2006;16:430-46. https://doi.org/10.1123/ijsnem.16.4.430
80. Tyka A, Chwastowski M, Cison T, et al. Effect of creatine malate supplementation on physical performance, body composition and selected hormone levels in sprinters and long-distance runners. *Acta Physiol Hung* 2015;102:114-22. https://doi.org/10.1556/APhysiol.102.2015.1.12
81. El Taieb M, Hegazy E, Ibrahim A. Daily oral l-arginine plus tadalafil in diabetic patients with erectile dysfunction: A double-blinded, randomized, controlled clinical trial. J *Sex Med* 2019;16:1390-7. https://doi.org/10.1016/j.jsxm.2019.06.009
82. Benefits of magnesium for men's health. *Annie's Apothecary.* Available at: https://anniesrx.com/articles/benefits-of-magnesium-for-mens-health (accessed May 5, 2025)
83. Men's health and the importance of calcium. Marah Natural. June 15, 2022. Available at: https://www.marahnatural.com/blogs/blog/mens-health-and-the-importance-of-calcium (accessed May 5, 2025)
84. Whittaker G. 5 Surprising benefits of zinc sexually. *Hims.* June 13, 2023. Available at: https://www.hims.com/blog/benefits-zinc-sexually (accessed May 5, 2025)
85. Cinar V, Polat Y, Baltaci AK, et al. Effects of magnesium supplementation on testosterone levels of athletes and sedentary subjects at rest and after exhaustion. *Biol Trace Elem Res* 2011;140:18-23. https://doi.org/10.1007/s12011-010-8676-3

86. Cinar V, Baltaci AK, Mogulkoc R, et al. Testosterone levels in athletes at rest and exhaustion: Effects of calcium supplementation. *Biol Trace Elem Res* 2009;129:65-9. https://doi.org/10.1007/s12011-008-8294-5
87. Koehler K, Parr MK, Geyer H, et al. Serum testosterone and urinary excretion of steroid hormone metabolites after administration of a high-dose zinc supplement. *Eur J Clin Nutr* 2009;63:65-70. https://doi.org/10.1038/sj.ejcn.1602899
88. Clarke TC, Black LI, Stussman BJ, et al. Trends in the use of complementary health approaches among adults: United States, 2002-2012. *Natl Health Stat Rep* 2015;1.
89. Esmail N. Complementary and alternative medicine: Use and public attitudes 1997, 2006, and 2016. Fraser Institute. April 25, 2017. Available at: https://www.fraserinstitute.org/studies/complementary-and-alternative-medicine-use-and-public-attitudes-1997-2006-and-2016 (accessed March 27, 2025)