



The Use of Tongkat Ali in Andrology: The Available Evidence

Aamir Jalal Al-Mosawi*

¹Advisor in Pediatrics and Pediatric Psychiatry and Expert Trainer, The National Training and Development Center and Baghdad Medical City, Iraq

²Visiting Professor and Expert Trainer, Corporate Training, Bangkok



Abstract

Tongkat Ali (*Eurycoma longifolia* Jack), a traditional Southeast Asian medicinal plant, has garnered increasing scientific interest for its potential benefits in male reproductive health, androgen deficiency, and overall physiological performance. This paper synthesizes three decades of research, integrating experimental studies, mechanistic insights, and clinical investigations.

Preclinical evidence demonstrates that Tongkat Ali enhances sexual motivation, libido, penile reflexes, erectile function, spermatogenesis, and testosterone production across diverse animal models. Mechanistic studies identify key bioactive compounds particularly quassinoids and canthin-6-one derivatives - that act through androgen-dependent and independent pathways, including Leydig cell stimulation, phosphodiesterase-5 inhibition, smooth muscle modulation, and aromatase inhibition. Beyond reproductive effects, Tongkat Ali exhibits anxiolytic, anabolic, bone-protective, nephroprotective, and metabolic benefits.

Clinical trials corroborate these findings, showing improvements in semen quality, serum testosterone levels, muscle strength, physical performance, mood, and quality of life in men with infertility, late-onset hypogonadism, or age-related androgen decline. Most studies report a favorable safety profile, though isolated cases of hepatotoxicity highlight the need for careful monitoring.

By bridging experimental evidence with clinical applications, this paper provides a comprehensive, evidence-based overview of Tongkat Ali's multifaceted role in male health. It serves as a resource for researchers, clinicians, and healthcare professionals interested in natural therapeutic approaches for sexual, hormonal, and systemic well-being.

Keywords: Tongkat Ali; Therapeutic Applications; Andrology

Tongkat Ali (Malaysian ginseng or long jack) is a dietary supplement that include the root of *Eurycoma longifolia* Jack, a natural plant belonging to the Simaroubaceae family. It is Generally Recognized As Safe (GRAS) by the FDA.

In 1997 and 1998, Hooi Hoon ANG and Meng Kwoon SIM reported two experimental studies in male rats receiving Tongkat Ali 200 mg, 400 mg and 800 mg/kg body weight of Tongkat Ali two times daily for 10 days. Tongkat ali was associated with a dose-dependent stimulation of sexual arousal with an increase in frequency of mounting and also the frequency of licking and anogenital sniffing towards the receptive females. The authors concluded that Tongkat Ali has an aphrodisiac property [1, 2].

In 1999, Hooi Hoon Ang and Hung Seong Cheang reported an experimental study in mice which demonstrated anxiolytic activity of Tongkat Ali [3].

In 2000, Ang and colleagues reported an experimental study which included castrated male rats receiving Tongkat Ali 200 mg, 400 mg and 800 mg/kg body weight of Tongkat Ali two times daily for 10 days. Tongkat Ali increased sexual performance of the treated rats [4].

In 2001, Ang and colleagues reported two experimental studies in male rats [5, 6]. The first showed that Tongkat Ali was associated with a dose-dependent, recurrent and marked increase in penile reflexes [5], and both studies suggested an aphrodisiac property [5, 6].

During the same year, Hooi Hoon Ang and Hung Seong Cheang reported a 12-week rat study which showed that high-dose (800 mg/kg) fractions of Tongkat Ali significantly increased levator

OPEN ACCESS

*Correspondence:

Aamir Jalal Al-Mosawi, Advisor in Pediatrics and Pediatric Psychiatry and Expert Trainer, The National Training and Development Center and Baghdad Medical City, Iraq,
E-mail: almosawiAJ@yahoo.com

Received Date: 11 Sep 2026

Accepted Date: 09 Oct 2026

Published Date: 10 Oct 2026

Citation:

Aamir Jalal Al-Mosawi. The Use of Tongkat Ali in Andrology: The Available Evidence. WebLog J Nutr Food Sci. wjnfs.2026.j1005. <https://doi.org/10.5281/zenodo.23338302>

Copyright© 2026 Aamir Jalal Al-Mosawi. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ani muscle weight, a common preclinical marker of androgenic activity [7].

In 2002, Hooi Hoon Ang and Kheng Leng Lee reported a study in middle-aged male rats which showed that a high dose (800 mg/kg) Tongkat Ali was associated with considerable increase in libido and mount frequency [8].

During the same year, the authors reported another study in middle-aged male rats which showed that high-dose Tongkat Ali (800 mg/kg) administered for 10 days increased sexual orientation behaviors, including anogenital sniffing, licking, and mounting toward receptive females. The treatment also increased genital grooming; suggesting enhanced sexual motivation [9].

In 2003, Ang and colleagues reported a 12-week study which showed that Tongkat Ali 0.5 g/kg enhanced sexual performance in middle-aged male rats by reducing hesitation time compared with saline-treated controls [10].

During the same year, Ang and colleagues reported a 10-day study in adult and middle-aged male mice, including retired breeders which showed that Tongkat Ali (500 mg/kg) enhanced sexual motivation, as measured by modified open field and runway choice tests [11].

In 2004, Ang and colleagues reported a study in sexually sluggish old male rats which showed that Tongkat Ali (800 mg/kg) twice daily for 10 days markedly increased sexual arousal [12].

The earliest twelve experimental studies conducted by Hooi Hoon Ang and colleagues between 1997 and 2004 provided a consistent body of preclinical evidence supporting the biological activity of Tongkat Ali in male reproductive health and sexual behavior [1-12].

Across a variety of animal models including normal adult rats, castrated rats, middle-aged rats, sexually sluggish old rats, and mice, Tongkat Ali repeatedly demonstrated enhancement of sexual motivation, sexual arousal, libido, mounting frequency, and other mating-related behaviors. The effects were generally dose-dependent, with the most pronounced responses observed at higher doses (500-800 mg/kg). Several studies also showed increased penile reflexes, reduced hesitation before mating, and improved sexual orientation toward receptive females, indicating enhancement of both sexual desire and sexual performance.

Beyond its aphrodisiac effects, Tongkat Ali exhibited anxiolytic activity in mice and androgenic properties in rats, as evidenced by increased levator ani muscle weight after prolonged administration. These findings suggest that the observed improvements in sexual behavior may be related not only to behavioral stimulation but also to androgen-mediated physiological mechanisms.

An important strength of this series of investigations is the reproducibility of findings across different animal populations and experimental paradigms. Whether administered to young, middle-aged, aged, or castrated animals, Tongkat Ali consistently improved parameters associated with male sexual function. The progressive nature of the research also demonstrated a coherent scientific development, beginning with observations of enhanced sexual behavior and later exploring penile reflexes, androgenic effects, sexual motivation, and age-related sexual decline.

Overall, the twelve studies provided substantial experimental evidence that Tongkat Ali possesses aphrodisiac, pro-libido, sexual performance-enhancing, anxiolytic, and androgenic activities in

animal models [1-12].

In 2009, Zanolini *et al.*, from Italy reported a study in adult male rats classified as sexually sluggish or impotent which showed that Tongkat Ali root powder (250-1000 mg/kg for one day) and (500 mg/kg for 6 days) considerably improved sexual performance in sluggish rats by reducing ejaculation latency and increasing the proportion of mounting and ejaculating animals.

Tongkat Ali (500 mg/kg for 6 days) and (500 mg/kg for 12 days) enhanced performance in impotent rats. Tongkat Ali (500 mg/kg for 6 days) increased serum testosterone levels. The authors concluded that Tongkat Ali may enhance male sexual performance primarily through testosterone elevation [13].

In 2010, Wahab *et al.*, reported a study in adult male Sprague-Dawley rats which showed that oral administration of Tongkat Ali for 2 weeks increased spermatogenic cell counts, epididymal sperm counts, and sperm motility compared to controls. Estradiol (E₂) treatment alone caused a marked decrease in both spermatogenesis and sperm counts, reflecting estrogen-induced reproductive suppression. Notably, combined Tongkat Ali and Estradiol (E₂) treatment mitigated these negative effects, suggesting Tongkat Ali can counteract estrogen-related reproductive impairments [14].

In 2010, Ahmad Nazrun Shuid from Malaysia and his research team reported a study in orchidectomized aged rats which showed that Tongkat Ali supplementation preserved bone calcium content, indicating a protective effect against bone mineral loss. However, its effects were less pronounced than testosterone replacement therapy. The authors concluded that Tongkat Ali may have potential clinical value in managing androgen-deficient osteoporosis, particularly in conditions associated with low testosterone levels [15].

In 2012, Rosmaliza Ramli from Malaysia and her colleagues evaluated the effects of Tongkat Ali on bone microarchitecture in 48 aged (10-12 months old) Sprague Dawley rats. Testosterone replacement successfully reversed the adverse changes in trabecular bone microarchitecture induced by orchidectomy. In contrast, Tongkat Ali at doses of 30 and 60 mg/kg worsened trabecular connectivity density and separation, whereas the highest dose (90 mg/kg) preserved trabecular bone volume. The authors concluded that high-dose Tongkat Ali may help preserve bone microarchitecture in androgen-deficient rats, while lower doses may exacerbate osteoporotic changes [16].

During the same year, Wen-Fei Chiou and Tian-Shung Wu from Taiwan reported that the alkaloid 9-hydroxycanthin-6-one (9-HC-6-one), isolated from the Tongkat Ali plant (*Eurycoma longifolia*), promoted penile erection and delayed ejaculation in rat models by relaxing smooth muscle in the corpus cavernosum and seminal vesicles. Its effects appeared to be independent of the nitric oxide pathway and were primarily mediated through inhibition of calcium mobilization and calcium-channel activity. The compound also increased intracavernosal pressure and reduced nerve-stimulated seminal vesicle contractions, findings consistent with improved erectile function and delayed ejaculation [17].

Ahmad Nazrun Shuid from Malaysia and his research group (2012) reported a study in male Sprague-Dawley rats which showed that supplementation with Tongkat Ali extract in testosterone-deficient (orchidectomized) rats increased serum testosterone levels and reduced bone resorption, indicating a potential protective effect against androgen-deficiency-related bone loss.

Treatment lowered levels of the bone resorption marker C-terminal telopeptide of type I collagen (CTX) and increased expression of Osteoprotegerin (OPG), a key regulator that inhibits bone breakdown. These findings suggest that Tongkat Ali may help preserve bone health by modulating pathways involved in bone remodeling. However, no significant improvements were observed in bone biomechanical strength during the study period [18].

In 2013, Ching-Hao Li from Taiwan and his research team reported a toxicological study which showed that Tongkat Ali has a favorable safety profile, with no evidence of mutagenic or clastogenic effects and an acute oral LD50 exceeding 6 g/kg body weight. Repeated administration for up to 13 weeks did not produce adverse effects on body weight, hematological parameters, organ pathology, or clinical biochemistry. Interestingly, supplementation significantly reduced markers such as cholesterol, creatinine, blood urea nitrogen, liver enzymes, and coagulation times, particularly in male subjects, suggesting potential pharmacological benefits. The authors concluded that Tongkat Ali can be safely used as a health supplement at recommended doses while potentially supporting metabolic and cardiovascular health. Based on the toxicological assessment, an Acceptable Daily Intake (ADI) of up to 1.2 g per adult per day was proposed for clinical and commercial applications [19].

During the same year, Bin-Seng Low and colleagues reported a study in rats which showed that a standardized bioactive fraction of Tongkat Ali rich in the quassinoid eurycomanone (F2), markedly increased sperm concentration, spermatocyte and spermatid numbers, and overall sperm production. Treatment with F2 also improved fertility outcomes, including higher fertility and fecundity indices and increased litter size. Hormonal analyses showed elevated plasma and testicular testosterone levels, accompanied by increased luteinizing hormone and follicle-stimulating hormone and reduced estrogen levels. Histological findings revealed enhanced spermatogenesis and a greater number of Leydig cells in the testes. *In vitro* studies further confirmed that eurycomanone and related quassinoids stimulated testosterone release from Leydig cells. These findings suggest that Tongkat Ali supplementation can modulate the hypothalamic-pituitary-gonadal axis [20].

Catherine Ulbricht from the United States and her research team reported an evidence-based systematic review conducted in 2013 by the Natural Standard Research Collaboration which consolidated the safety of Tongkat Ali [21].

Low *et al.*, (2013) investigated the effects of eurycomanone, the principal bioactive compound in Tongkat Ali, on isolated rat testicular Leydig cell-rich interstitial cells cultured in M199 medium. The study demonstrated a significant dose-dependent increase in testosterone production at concentrations of 0.1, 1.0, and 10.0 μ M ($P < 0.05$). Mechanistic analyses suggested that eurycomanone enhances testosterone steroidogenesis primarily through inhibition of aromatase-mediated conversion of testosterone to estrogen. At higher concentrations, the compound may also exert phosphodiesterase inhibitory activity, further supporting androgen production [22].

In 2014, Solomon and colleagues from South Africa reported a rat study demonstrating that two weeks of Tongkat Ali supplementation increased testosterone levels by 30.2% and was associated with increased muscle weight. Supplementation also significantly improved sperm concentration, total and progressive motility, and vitality, while markedly enhancing mitochondrial membrane

potential. In addition, body weight decreased by 5.7% and omental fat by 31.9%. No significant changes were observed in the weights of the prostate, testes, or epididymides. As no harmful effects were detected, the authors concluded that Tongkat Ali appeared to be safe [23].

In 2017, Hnin Ei Thu and her research group from Malaysia demonstrated that Tongkat Ali was more effective than testosterone in promoting the proliferation and osteogenic differentiation of MC3T3-E1 cells. Their study provided *in vitro* evidence suggesting the potential of Tongkat Ali for the prevention of male osteoporosis [24].

During the year 2018, Putri Ayu Jayusman from Malaysia and her research team reported two experimental studies male Sprague-Dawley rats showed that quassinoid-rich Tongkat Ali extract helped protect against bone loss associated with androgen deficiency. While testosterone therapy produced greater improvements in bone mineral density and trabecular bone microarchitecture, Tongkat Ali showed comparable benefits in maintaining cortical bone thickness. The extract also improved several biomechanical properties of bone, including stiffness, strain, and elasticity, indicating enhanced bone strength. These findings suggest that Tongkat Ali may help preserve skeletal health in conditions of low testosterone [25].

The second study showed that Tongkat Ali supplementation reduced bone deterioration in male rats with androgen deficiency caused by surgical or chemical castration. Treatment improved key indicators of bone health, including increased bone volume and trabecular number, while reducing trabecular separation and osteoclast activity. Tongkat Ali also promoted bone formation by increasing osteoblast presence and enhancing dynamic bone remodeling markers. Modest but significant increases in serum testosterone were observed in some treatment groups, suggesting a potential androgen-supporting effect [26].

During the same year, Ganiyu Oboh and colleagues from Nigeria reported an *in vitro* study which showed that Tongkat Ali extract inhibited several enzymes associated with erectile dysfunction, including phosphodiesterase-5 (PDE-5), arginase, and Angiotensin-Converting Enzyme (ACE). The extract also exhibited antioxidant activity by reducing oxidative stress-induced lipid peroxidation in penile tissue. These mechanisms may help support erectile function through improved nitric oxide availability, vascular function, and protection against oxidative damage. Although Tongkat Ali showed biological activity, its effects were less potent than those of *Cylicodiscus gabunensis* in this laboratory model [27].

In 2019, Sasikala M Chinnappan and her research team from Malaysia and India reported a study which suggested that Tongkat Ali did not show evidence of kidney toxicity in rats, and instead demonstrated a dose-dependent protective effect against paracetamol (acetaminophen)-induced kidney damage.

Rats treated with Tongkat Ali had improved kidney function markers, including lower serum creatinine and blood urea levels, higher creatinine clearance, and better protein and albumin levels compared with rats receiving paracetamol alone.

Histopathological analysis also showed reduced kidney tissue damage in Tongkat Ali-treated groups. These findings support a potential nephroprotective effect and provide preliminary reassurance regarding renal safety in this animal model [28].

During the same year, Shahira M Ezzat and her research team

from Egypt and Malaysia reported an *in vitro* study which showed that Tongkat Ali caused significant inhibition of ROCK-II, an enzyme involved in smooth muscle contraction, which may help explain its traditional use for male sexual health.

The aqueous extract and several isolated compounds showed strong biological activity in laboratory testing, with some compounds approaching the effectiveness of a standard ROCK-II inhibitor [29].

During the same year, Shahira M Ezzat and her research group from Egypt and Malaysia reported a metabolic profiling of the aqueous extract of Tongkat Ali using UPLC-MS/MS in both positive and negative modes. They identified 17 metabolites which were classified into four groups including quassinoids, alkaloids, triterpenes, and biphenylneolignans. Shahira M Ezzat and her research considered Tongkat Ali to be safe with oral LD50 cut-off >5000 mg/kg.

Shahira M Ezzat and her research team reported a study, which showed that oral administration of 50, 100 mg, 200 mg, 400 mg, or 800 mg/kg of Tongkat Ali for 10 consecutive days to Sprague-Dawley male rats caused considerable increase in penile erection index. Tongkat Ali increased total body weight and the relative weights of prostate and seminal vesicles. Total and free serum testosterone and brain cortical and hippocampal dopamine content were markedly increased with no important effects on serotonin or noradrenaline content [30].

Bee Ping and her research team from Malaysia reported a 28-day repeated-dose toxicity study in Wistar rats. A polyherbal formulation containing Tongkat Ali and Kacip Fatimah (*Labisia pumila*) showed no significant signs of toxicity at doses up to 2000 mg/kg body weight. No adverse effects were observed in terms of mortality, behavior, body weight, food and water intake, hematological parameters, or serum biochemistry. However, microscopic histopathological changes were detected in some organs at the highest dose (2000 mg/kg), suggesting a possible early biological response to the formulation. The No-Observed-Adverse-Effect Level (NOAEL) was estimated to be greater than 500 mg/kg but not exceeding 2000 mg/kg body weight. These findings indicate a generally favorable safety profile [31].

Jerônimo P Martins from Brazil and his research team evaluated Tongkat Ali alongside resistance exercise in a mouse model of early sarcopenia induced by hormone deficiency. In orchidectomized male mice, Tongkat Ali supplementation helped in reducing excess body fat when combined with exercise and improved overall physical activity. It also enhanced functional performance by shortening ladder-climbing time, suggesting improved muscular endurance and mobility [32].

Rattanathorn Choonong from Thailand and his research team reported an *in vitro* study which demonstrated that Tongkat Ali extract exhibit significant Phosphodiesterase-5 (PDE-5) inhibitory activity, a mechanism similar to that targeted by drugs used for erectile dysfunction. The observed activity was largely attributed to canthin-6-one alkaloids, particularly canthin-6-one-9-O- β -D-glucopyranoside, which showed strong enzyme inhibition at low micromolar concentrations [33].

In 2023, Mathias-Mathew Hipolith and colleagues from Malaysia and Japan reported a study investigating the effects of Tongkat Ali quassinoids on Benign Prostatic Hyperplasia (BPH). Their research included both *in vitro* and *in vivo* experiments:

In vitro findings: Certain quassinoids selectively reduced the

viability of human BPH-1 cells, indicating potential anti-BPH activity. However, some compounds also exhibited cytotoxic effects on normal fibroblasts, highlighting the need for careful safety evaluation.

In vivo findings: One specific quassinoid (referred to as compound 2) significantly decreased prostate weight and improved histological markers of BPH in testosterone-induced rat models [34].

In 2025, Sukardiman and his colleagues from Indonesia conducted a systematic review and pharmacological network overview. The pharmacology network analysis revealed that the compounds present in Tongkat Ali including stigmasterol, eurycomanone, and eurycomalactone, target 13 genes associated with erectile dysfunction. These genes are connected to the biological mechanisms underlying steroid hormone biosynthesis, which is essential for the formation of testosterone [35].

Clinical Applications of Tongkat Ali in Andrology

The first clinical study reported the use of Tongkat Ali was published in 2010 by Mohd Ismail Bin Mohd Tambi and Kamarul Imran Musa from Malaysia. The study included 75 patients with idiopathic infertility treated with Tongkat Ali (200 mg daily) for 3 months. Treatment was associated with considerable improvement in all semen parameters. The proprietary extract of *Eurycoma longifolia* Jack significantly improved the sperm quality in these patients, allowing for 11 (14.7%) spontaneous pregnancies [36].

In 2012, Tambi and colleagues reported a study which included 320 patients who had late-onset hypogonadism, 76 of them were treated with a standardized water-soluble extract of Tongkat Ali (200 mg daily) for one month. Treatment was associated with significant ($P < 0.0001$) symptomatic improvement and improved levels of serum testosterone concentration [37].

In 2013, Shawn M Talbott from the United States and his research team reported a study which included 32 males and showed that supplementation with tongkat Ali root extract improved stress hormone profile and certain mood state parameters [38].

In 2014, Ralf R Henkel from South Africa and his research team reported a study which included 13 physically active males (Age: 57-72 years) who received supplementation with Tongkat Ali extract (400 mg per day) for five weeks. Supplementation was associated with considerable increase in total and free testosterone levels and muscular force tested by a simple handgrip test [39].

During the same year, Annie George from Malaysia and Ralf R Henkel from South Africa reviewed the literature and suggested that Tongkat represents a natural alternative to testosterone replacement therapy for managing testosterone deficiency syndrome. Evidence suggests that it may help restore testosterone levels and improve sexual function, bone health, and overall physical performance. Additional benefits, including anti-hyperglycemic effects and potential anticancer activity against prostate cancer cells, further support its therapeutic potential. Importantly, current studies have reported minimal adverse effects at therapeutic doses, indicating a favorable safety profile [40].

In 2017, Hnin Ei Thu from Malaysia and her research group conducted systematic review on clinical studies which involved 11 studies including randomized placebo-controlled trials, multiple cohort studies, and pilot trials. All the 11 studies reported significant

effects of Tongkat Ali on male sexual abnormalities. Seven studies reported the effectiveness of Tongkat Ali in the treatment of male sexual disorders [41].

In 2019, Chee Keong Chen and his research team from Malaysia reported a placebo-controlled study which included 40 young males. The study suggested that Tongkat Ali at a dose of 200 mg daily for 8 weeks may enhance the benefits of resistance training on muscular performance in healthy young men.

While resistance training alone improved lower-limb power and relative anaerobic performance, the combination of Tongkat Ali and resistance training resulted in greater improvements in peak power output. Tongkat Ali supplementation by itself did not significantly affect muscular strength, power, or anaerobic capacity. Importantly, supplementation did not alter the urinary Testosterone-to-Epitestosterone (T/E) ratio, indicating no detectable effect on this hormonal marker. Clinically, these findings suggest that Tongkat Ali may serve as an adjunct to resistance training for improving peak athletic performance, although its independent ergogenic and hormonal effects appear limited in healthy young males [42].

Alice Erwig Leitão from Brazil and her research team reported the use of Tongkat Ali supplementation as a non-pharmacological intervention for androgen deficiency in aging males in a six-month placebo-controlled study.

The study showed that Tongkat Ali combined with concurrent training was associated with marked improvements in muscle strength, particularly in knee extensor and flexor performance. Improvements in muscle strength were positively correlated with testosterone levels, suggesting a potential androgen-enhancing effect. Both the exercise-only and exercise-plus-Tongkat Ali groups experienced significant reductions in androgen deficiency symptoms, with the greatest improvement observed in the combined intervention group. These findings indicate that Tongkat Ali may be clinically useful as an adjunct to exercise for improving physical function and alleviating symptoms associated with age-related androgen deficiency [43].

During the same year, Kai Quin Chan and his research team from Malaysia and the United Kingdom reported a placebo-controlled study which included 32 males (24.4 ± 4.7 years) who received either Tongkat Ali (600 mg daily) or placebo for two weeks. Tongkat Ali was associated with marked interaction and time effects for testosterone, free testosterone and estradiol levels. No changes were observed in luteinizing hormone, follicle-stimulating hormone and sexual hormone-binding globulin. The lack of changes in luteinizing hormone and follicle-stimulating hormone levels suggested that the increased testosterone level may be caused by increased hormone production via the hypothalamic-pituitary-adrenal axis.

The authors concluded that Tongkat Ali supplementation for 2 weeks has dose-related steroidogenic effects on young males, and the increased testosterone level improve muscle and strength gain in young adult males [44].

In 2021, Sasikala M Chinnappan and her research group from Malaysia and India reported a study which included 105 males (Age: 50-70 years) who had a testosterone level <300 ng/dL, BMI ≥ 18 and ≤ 30.0 kg/m². They received Tongkat Ali 100 mg, 200 mg daily or placebo for 12 weeks.

The use of Tongkat Ali was associated with a marked increase in

the total testosterone levels at week 12 with 100 mg dose, at weeks 4, 8, and 12 with 200 doses.

Tongkat Ali was also associated with marked increase in muscle strength with a marked reduction in Ageing Male Symptoms (AMS) score and Fatigue Severity Scale (FSS) total score.

In addition, Tongkat Ali markedly increased dihydroepiandrosterone levels, while markedly decreased cortisol levels.

There were no important changes in Sex Hormone-Binding Globulin (SHBG).

The authors concluded that Tongkat Ali supplementation (200 mg daily) can increase serum total testosterone, reduce fatigue and improve the quality of life in ageing males within 2 weeks [45].

In 2022, Kristian Leisegang and his research team from South Africa, United Kingdom and United States conducted a systematic review and meta-analysis of randomized clinical trials involving a total of 9 studies included in the systematic review. Five randomized clinical trials were included in the meta-analysis. The study found that the use of Tongkat Ali healthy volunteers and hypogonadal men was associated with marked improvement in total testosterone levels [46].

In 2023, Aboud Kaliounji and his research team from the United States reported the first published case of acute liver injury associated with Tongkat Ali supplementation in a 47-year-old male. The patient developed jaundice and markedly elevated liver enzymes shortly after initiating Tongkat Ali use, with clinical improvement observed following discontinuation of the supplement. Extensive evaluation excluded alternative causes of liver injury, supporting a diagnosis of herb-induced liver injury. The case suggests that individual genetic and metabolic factors may influence susceptibility to hepatotoxicity. Although Tongkat Ali is generally considered safe, this report highlights the potential risk of liver injury and the need for careful monitoring and cautious clinical use [47].

In 2024, Afonso Morgado from Portugal and his international team conducted a systematic review of 52 studies on 27 testosterone boosters; Tongkat Ali (*Eurycoma longifolia*) was one of the few supplements associated with potential testosterone-enhancing effects. Evidence suggested it was possibly effective in men with late-onset hypogonadism, showing improvements in total testosterone compared with placebo in some studies. Tongkat Ali was also considered possibly effective in healthy men, unlike most tested supplements that failed to significantly increase testosterone [48].

Conclusion

By bridging experimental evidence with clinical applications, this paper provides a comprehensive, evidence-based overview of Tongkat Ali's multifaceted role in male health. It serves as a resource for researchers, clinicians, and healthcare professionals interested in natural therapeutic approaches for sexual, hormonal, and systemic well-being.

References

1. Ang HH, Sim MK. *Eurycoma longifolia* Jack enhances libido in sexually experienced male rats. *Exp Anim*. 1997; 46(4): 287-290.
2. Ang HH, Sim MK. *Eurycoma longifolia* JACK and orientation activities in sexually experienced male rats. *Biol Pharm Bull*. 1998; 21(2): 153-155.
3. Ang HH, Cheang HS. Studies on the anxiolytic activity of *Eurycoma*

- longifolia Jack roots in mice. *Jpn J Pharmacol.* 1999; 79(4): 497-500.
4. Ang HH, Cheang HS, Yusof AP. Effects of *Eurycoma longifolia* Jack (Tongkat Ali) on the initiation of sexual performance of inexperienced castrated male rats. *Exp Anim.* 2000; 49(1): 35-38.
 5. Ang HH, Ikeda S, Gan EK. Evaluation of the potency activity of aphrodisiac in *Eurycoma longifolia* Jack. *Phytother Res.* 2001; 15(5): 435-436.
 6. Ang HH, Ngai TH. Aphrodisiac evaluation in non-copulator male rats after chronic administration of *Eurycoma longifolia* Jack. *Fundam Clin Pharmacol.* 2001; 15(4): 265-268.
 7. Ang HH, Cheang HS. Effects of *Eurycoma longifolia* jack on laevator ani muscle in both uncastrated and testosterone-stimulated castrated intact male rats. *Arch Pharm Res.* 2001; 24(5): 437-440.
 8. Ang HH, Lee KL. Effect of *Eurycoma longifolia* Jack on libido in middle-aged male rats. *J Basic Clin Physiol Pharmacol.* 2002; 13(3): 249-254.
 9. Ang HH, Lee KL. Effect of *Eurycoma longifolia* Jack on orientation activities in middle-aged male rats. *Fundam Clin Pharmacol.* 2002; 16(6): 479-483.
 10. Ang HH, Ngai TH, Tan TH. Effects of *Eurycoma longifolia* Jack on sexual qualities in middle aged male rats. *Phytomedicine.* 2003; 10(6-7): 590-593.
 11. Ang HH, Lee KL, Kiyoshi M. *Eurycoma longifolia* Jack enhances sexual motivation in middle-aged male mice. *J Basic Clin Physiol Pharmacol.* 2003; 14(3): 301-308.
 12. Ang HH, Lee KL, Kiyoshi M. Sexual arousal in sexually sluggish old male rats after oral administration of *Eurycoma longifolia* Jack. *J Basic Clin Physiol Pharmacol.* 2004; 15(3-4): 303-309.
 13. Zanoli P, Zavatti M, Montanari C, Baraldi M. Influence of *Eurycoma longifolia* on the copulatory activity of sexually sluggish and impotent male rats. *J Ethnopharmacol.* 2009; 126(2): 308-313.
 14. Wahab NA, Mokhtar NM, Halim WN, Das S. The effect of *eurycoma longifolia* Jack on spermatogenesis in estrogen-treated rats. *Clinics.* 2010; 65(1): 93-98.
 15. Shuid AN, Abu Bakar MF, Abdul Shukor TA, Muhammad N, Mohamed N, Soelaiman IN. The anti-osteoporotic effect of *Eurycoma Longifolia* in aged orchidectomised rat model. *Aging Male.* 2011; 14(3): 150-154.
 16. Ramli R, Khamis MF, Shuid AN. Bone Micro-CT Assessments in an Orchidectomised Rat Model Supplemented with *Eurycoma longifolia*. *Evid Based Complement Alternat Med.* 2012; 2012: 501858.
 17. Chiou WF, Wu TS. 9-hydroxycanthin-6-one induces penile erection and delays ejaculation. *J Sex Med.* 2012; 9(4): 1027-1036.
 18. Shuid AN, El-arabi E, Effendy NM, Razak HS, Muhammad N, Mohamed N, et al. *Eurycoma longifolia* upregulates osteoprotegerin gene expression in androgen- deficient osteoporosis rat model. *BMC Complement Altern Med.* 2012; 12: 152.
 19. Li CH, Liao JW, Liao PL, Huang WK, Tse LS, Lin CH, et al. Evaluation of Acute 13-Week Subchronic Toxicity and Genotoxicity of the Powdered Root of Tongkat Ali (*Eurycoma longifolia* Jack). *Evid Based Complement Alternat Med.* 2013; 2013: 102987.
 20. Low BS, Das PK, Chan KL. Standardized quassinoid-rich *Eurycoma longifolia* extract improved spermatogenesis and fertility in male rats via the hypothalamic-pituitary-gonadal axis. *J Ethnopharmacol.* 2013; 145(3): 706-714.
 21. Ulbricht C, Conquer J, Flanagan K, Isaac R, Rusie E, Windsor RC. An evidence-based systematic review of Tongkat ali (*Eurycoma longifolia*) by the Natural Standard Research Collaboration. *J Diet Suppl.* 2013; 10(1): 54-83.
 22. Low BS, Choi SB, Abdul Wahab H, Das PK, Chan KL. *Eurycomanone*, the major quassinoid in *Eurycoma longifolia* root extract increases spermatogenesis by inhibiting the activity of phosphodiesterase and aromatase in steroidogenesis. *J Ethnopharmacol.* 2013; 149(1): 201-207.
 23. Solomon MC, Erasmus N, Henkel RR. In vivo effects of *Eurycoma longifolia* Jack (Tongkat Ali) extract on reproductive functions in the rat. *Andrologia.* 2014; 46(4): 339-348.
 24. Thu HE, Mohamed IN, Hussain Z, Shuid AN. *Eurycoma longifolia* as a potential alternative to testosterone for the treatment of osteoporosis: Exploring time-mannered proliferative, differentiative and morphogenic modulation in osteoblasts. *J Ethnopharmacol.* 2017; 195: 143-158.
 25. Jayusman PA, Mohamed IN, Alias E, Dom SM, Shuid AN. Effects of standardized quassinoid-rich *Eurycoma longifolia* extract in a rat model of osteoporosis due to testosterone deficiency: A densitometric, morphometric and biomechanical study. *J Xray Sci Technol.* 2018; 26(4): 643-656.
 26. Jayusman PA, Mohamed IN, Alias E, Mohamed N, Shuid AN. The Effects of Quassinoid-Rich *Eurycoma longifolia* Extract on Bone Turnover and Histomorphometry Indices in the Androgen-Deficient Osteoporosis Rat Model. *Nutrients.* 2018; 10(7): 799.
 27. Oboh G, Adebayo AA, Ademosun AO. Phenolic-rich extracts of *Eurycoma longifolia* and *Cylicodiscus gabunensis* inhibit enzymes responsible for the development of erectile dysfunction and are antioxidants. *J Basic Clin Physiol Pharmacol.* 2018; 29(6): 689-696.
 28. Chinnappan SM, George A, Thaggikuppe P, Choudhary Y, Choudhary VK, Ramani Y, Dewangan R. Nephroprotective Effect of Herbal Extract *Eurycoma longifolia* on Paracetamol-Induced Nephrotoxicity in Rats. *Evid Based Complement Alternat Med.* 2019; 2019: 4916519.
 29. Ezzat SM, Okba MM, Ezzat MI, Aborehab NM, Mohamed SO. Rho-Kinase II Inhibitory Potential of *Eurycoma longifolia* New Isolate for the Management of Erectile Dysfunction. *Evid Based Complement Alternat Med.* 2019; 2019: 4341592.
 30. Ezzat SM, Ezzat MI, Okba MM, Hassan SM, Alkorashy AI, Karar MM, et al. Brain Cortical and Hippocampal Dopamine: A New Mechanistic Approach for *Eurycoma longifolia* Well-Known Aphrodisiac Activity and Its Chemical Characterization. *Evid Based Complement Alternat Med.* 2019; 2019: 7543460.
 31. Teh BP, Ahmad N, Ibnu Rasid EN, Zolkifli NA, Sastu Zakaria UR, Mohamed Yusoff N, et al. Herbal-Based Formulation Containing *Eurycoma longifolia* and *Labisia pumila* Aqueous Extracts: Safe for Consumption? *Pharmaceuticals.* 2021; 14(2): 142.
 32. Martins JP, Silva LC, Nunes MS, Rübensam G, Oliveira JR, Silva RBM, et al. Combined Effects of Exercise and Phytoanabolic Extracts in Castrated Male and Female Mice. *Nutrients.* 2021; 13(4): 1177.
 33. Choonong R, Chaingam J, Chantakul R, Mukda S, Temkithawon P, Ingkaninan K, et al. Phosphodiesterase-5 Inhibitory Activity of Canthin-6-One Alkaloids and the Roots of *Eurycoma longifolia* and *Eurycoma harmandiana*. *Chem Biodivers.* 2022; 19(7): e202200121.
 34. Hipolith MM, Khor BK, Hirasawa Y, Murugaiyah V, Lee CY, Morita H, et al. Quassinoids from *Eurycoma longifolia* Jack roots and their potential inhibitory activity against human benign prostatic hyperplasia cells (BPH-1) and testosterone-induced BPH rat model. *Fitoterapia.* 2023; 166: 105468.
 35. Sukardiman, Mutiah R, Handayani R. Potential and mechanisms of indigenous Indonesian medicinal plants in treating sexual dysfunction: A systematic review and pharmacological network overview. *Heliyon.* 2025; 11(3): e42501.
 36. Tambi MI, Imran MK. *Eurycoma longifolia* Jack in managing idiopathic male infertility. *Asian J Androl.* 2010; 12(3): 376-380.
 37. 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: 226-230.
 38. Talbott SM, Talbott JA, George A, Pugh M. Effect of Tongkat Ali on stress hormones and psychological mood state in moderately stressed subjects. *J*

- Int Soc Sports Nutr. 2013; 10(1): 28.
39. Henkel RR, Wang R, Bassett SH, Chen T, Liu N, Zhu Y, et al. Tongkat Ali as a potential herbal supplement for physically active male and female seniors: A pilot study. *Phytother Res*. 2014; 28(4): 544-550.
40. George A, Henkel R. Phytoandrogenic properties of *Eurycoma longifolia* as natural alternative to testosterone replacement therapy. *Andrologia*. 2014; 46(7): 708-721.
41. Thu HE, Mohamed IN, Hussain Z, Jayusman PA, Shuid AN. *Eurycoma Longifolia* as a potential adoptogen of male sexual health: A systematic review on clinical studies. *Chin J Nat Med*. 2017; 15(1): 71-80.
42. Chen CK, Ooi FK, Abu Kasim NA, Asari MA. Effects of *Eurycoma Longifolia* Jack Supplementation Combined with Resistance Training on Isokinetic Muscular Strength and Power, Anaerobic Power, and Urinary Testosterone: Epitestosterone Ratio in Young Males. *Int J Prev Med*. 2019; 10: 118.
43. Leitão AE, Vieira MCS, Gomes DA, Boing L, Pelegrini A, Luiz E, et al. Exercise associated or not to the intake of *Eurycoma longifolia* improves strength and cardiorespiratory fitness in men with androgen deficiency. *Complement Ther Clin Pract*. 2021; 42: 101301.
44. Chan KQ, Stewart C, Chester N, Hamzah SH, Yusof A. The effect of *Eurycoma Longifolia* on the regulation of reproductive hormones in young males. *Andrologia*. 2021; 53(4): e14001.
45. Chinnappan SM, George A, Pandey P, Narke G, Choudhary YK. Effect of *Eurycoma longifolia* standardised aqueous root extract-Physta® on testosterone levels and quality of life in ageing male subjects: a randomised, double-blind, placebo-controlled multicentre study. *Food Nutr Res*. 2021.
46. Leisegang K, Finelli R, Sikka SC, Panner Selvam MK. *Eurycoma longifolia* (Jack) Improves Serum Total Testosterone in Men: A Systematic Review and Meta-Analysis of Clinical Trials. *Medicina*. 2022; 58(8): 1047.
47. Kaliounji A, Shadid G, Saba H, Ahlawat S. A Rare Case of Tongkat Ali-Induced Liver Injury: A Case Report. *Cureus*. 2024; 16(3): e56639.
48. Morgado A, Tsampoukas G, Sokolakis I, Schoentgen N, Urkmez A, Sarikaya S. Do "testosterone boosters" really increase serum total testosterone? A systematic review. *Int J Impot Res*. 2024; 36(4): 348-364.