

# Review Ergogenic Effect of Long Jack, *Eurycoma Longifolia*

Thasanee Khanijou, Wannee Jiraungkoorskul<sup>1</sup>

Mahidol University International College, Mahidol University, Salaya Campus, Nakhon Pathom, <sup>1</sup>Department of Pathobiology, Faculty of Science, Mahidol University, Bangkok, Thailand

## ABSTRACT

*Eurycoma longifolia* (family: *Simaroubaceae*) is commonly distributed in the Southeast Asia and Indo-China. In particular, the aqueous extract and decoction of its root are a well-known folk medicine which enhances sexuality, fertility, and antiaging. Furthermore, it has been shown to possess anti-inflammatory, antimalarial, antimicrobial, and antioxidant properties. Its common phytochemical components include alkaloids, flavonoids, phenolics, saponins, tannins, and triterpenes. This plant is rich in various quassinoids including eurycolactone, eurycomalactone, eurycomanol, eurycomanone, and eurycomaoside all of which has been reported to contribute to its remedial properties including increased muscle strength, endurance in cycling time, and reduced anxiety and stress. Based on established literature on the health benefits of *E. longifolia*, this review article has attempted to compile *E. longifolia* to be one of the choices of ergogenic plants.

**Key words:** Ergogenic aids, *Eurycoma longifolia*, exercise, herb, plant, traditional medicine

## INTRODUCTION

An ergogenic aid is defined as any means of enhancing energy utilization, including energy production, control, and efficiency.<sup>[1]</sup> It has been classified into five categories: (i) Mechanical aid such as lightweight racing shoes, streamlined swimsuits, and solid disc wheels;<sup>[1]</sup> (ii) psychological aid such as hypnosis;<sup>[2]</sup> (iii) physiological aid such as sodium bicarbonate;<sup>[3]</sup> (iv) pharmacologic aid such as androgenic steroid supplement;<sup>[4]</sup> and (v) nutritional aid such as carbohydrate supplement<sup>[5]</sup> and fluid replacement.<sup>[6]</sup> An ethnobotanical survey of sports or exercise performance among tribal people in several countries was reported, for example, human performance from Canadian and American temperate biome<sup>[7]</sup> and wrestling in Kabye land of Togo.<sup>[8]</sup> Humans consume herbs to enhance their long-term endurance performance (e.g., in cycling, running, and swimming), to induce muscle strength (e.g., weightlifting and wrestling), or to reduce fatigue in sports events.<sup>[9]</sup> The following herbs in Table 1 are currently used to enhance physical performance with regards to scientific evidence of the effect.

The present review explores scientific evidence to provide updated information about the properties of *Eurycoma longifolia*, one of the ergogenic plants that is being investigated for its diverse exercise performance.

## Plant Description

*E. longifolia* is a medium-sized slender shrub that can reach 10–15 m in height and is often unbranched. They have compound leaves which

are 20–40 cm long and are crowded at the tip of the branches. Each compound leaf consists of 20–40 leaflets, ovate-lanceolate, sessile or nearly and are opposite. The flowers are dioecious, with male and female flowers on different trees; they are produced in large panicles, each flower having 5–6 very small petals. The fruit is green when ripened, blackish-red in color, 1–2 cm long, and 0.5–1.2 cm broad.<sup>[22]</sup>

## Taxonomical Classification

The taxonomy of *E. longifolia* is in the Kingdom (*Plantae*), division (Magnoliophyta), class (Magnoliopsida), order (*Sapindales*), family (*Simaroubaceae*), genus (*Eurycoma*), and species (*E. longifolia*).<sup>[23]</sup> The plant genus *Eurycoma* is a small genus of the family *Simaroubaceae*, which is comprised three species: *Eurycoma apiculate*, *Eurycoma harmandiana*, and *E. longifolia*, which are distributed across tropical and subtropical regions.<sup>[24]</sup>

## Nomenclature

*E. longifolia*, an herbal medicinal plant, originated from the Southeast Asia including Cambodia, Indonesia, Laos, Malaysia, Myanmar, Thailand, and Vietnam.<sup>[25,26]</sup> The vernacular names of *E. longifolia* include long Jack (English); bidara laut and pasak bumi (Indonesian); babi kurus (Japanese); penawar pahit, bedara merah, lempedu pahit, and tongkat ali (Malayalam); piak and tung saw (Thai); and cay ba benh, hau phat, and bba binh (Vietnamese).<sup>[27–29]</sup>

## Phytochemical Substances

Its active phytochemical substance are as follows: (1) Quassinoids<sup>[30]</sup> including eurycomanol,<sup>[31]</sup> eurycolactones A, eurycolactones B, eurycolactones C,<sup>[32]</sup> eurycolactone D,

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### Correspondence:

Dr. Wannee Jiraungkoorskul,  
Department of Pathobiology, Faculty of Science,  
Mahidol University, Bangkok 10400, Thailand.  
E-mail: wannee.jir@mahidol.ac.th

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**Table 1:** List of ergogenic plants regarding its properties

Property	Ergogenic plant
Antifatigue	<i>Caulis bambusae</i> , <sup>[10]</sup> <i>Rubus coreanus</i> , <sup>[11]</sup> <i>Cistanche deserticola</i> , <sup>[12]</sup> <i>Acanthopanax senticosus</i> , <sup>[13]</sup> <i>Abelmoschus esculentus</i> <sup>[14]</sup>
Antistress	<i>Eleutherococcus senticosus</i> and <i>Panax ginseng</i> , <sup>[15]</sup> <i>Ophiocordyceps sinensis</i> <sup>[16]</sup>
Endurance	<i>Tribulus terrestris</i> , <sup>[17]</sup> <i>Rhodiola rosea</i> , <sup>[18]</sup> <i>Anoectochilus formosanus</i> , <sup>[19]</sup> <i>Cordyceps sinensis</i> and <i>Rhodiola rosea</i> , <sup>[20]</sup> <i>Panax notoginseng</i> <sup>[21]</sup>

eurycolactone E, eurycolactone F,<sup>[33]</sup> hydroxylongilactone,<sup>[34]</sup> dehydroklaineaneone, 15 $\beta$ -O-acetyl-14-hydroxyklaineane none,<sup>[35]</sup> eurycomalactone,<sup>[36,37]</sup> eurycomanone,<sup>[38,39]</sup> and eurycomaoside.<sup>[26]</sup> (2) Alkaloids including  $\beta$ -carboline alkaloid,<sup>[40,41]</sup> cathine-6-one alkaloids.<sup>[42]</sup> (3) Triterpenes including tirucallane and eurylene.<sup>[43]</sup> (4) Propanoids including scopolin and propan.<sup>[34]</sup> (5) Biphenylneolignans.<sup>[44]</sup>

## Traditional Uses

The traditional uses or phytochemical properties of *E longifolia* from several literature reviews are antianxiety,<sup>[45,46]</sup> antibacterial,<sup>[25,29,47-49]</sup> anticancer,<sup>[35,38,50,51]</sup> antifungal,<sup>[28]</sup> anti-inflammation,<sup>[40,41,52,53]</sup> antimalarial,<sup>[54-57]</sup> antioxidant,<sup>[52]</sup> antiparasitic,<sup>[58]</sup> antiulcer,<sup>[59]</sup> ergogenic activities,<sup>[60,61]</sup> and reproductive improvement.<sup>[62-67]</sup>

## Ergogenic Property of *Eurycoma longifolia*

Kiew *et al.*<sup>[68]</sup> evaluated the effects of “AgroMas” a herbal drink available in the Malaysian market on endurance performance during cycling exercise in young cyclists ( $n = 9$ , age  $16.2 \pm 0.5$  years old). The compositions of this herbal drink per 100 ml are 0.1 mg *E. longifolia*, 2.0 mg *Cinnamomum cassia*, 2.9 mg calcium, 1.1 mg sodium, and 0.9 mg potassium. The subjects exercised on a cycle ergometer at  $71.9 \pm 0.7\%$  of maximal oxygen consumption until exhaustion on two occasions at 1-week intervals. During each exercise bout, participants received 3 ml/kg body weight of herbal drink or colored water placebo every 20 min in a double-blind, randomized study design. Endurance cycling time was 3.4% longer with the herbal drink compared with placebo,  $83.7 \pm 4.6$  min versus  $81.5 \pm 5.0$  min, but it was not significantly different. Changes in oxygen consumption, heart rate, and perceived rate of exertion were similar for both types of drinks. These results demonstrate that the herbal drink and the placebo elicited similar physiological responses and exercise performance during endurance cycling. It is therefore concluded that AgroMas’ herbal drink and water ingestion resulted in a similar ergogenic response on cycling performance in young cyclists. The researchers suggested that one of the reasons for the absence of a significant difference in cycling time could be due to lack of carbohydrates in the herbal drink. Other possible reasons could be due to the low concentration of herbs, *E. longifolia* Jack, in the drink. Muhamad *et al.*<sup>[69]</sup> studied 12 recreational athletes who consumed two capsules (150 mg) of *E. longifolia* or placebo capsules daily for 7 days. They reported that the amount of this herb had no effects on the endurance running performance and physiological responses. However, it has been reported by Hamzah and Yusof<sup>[60]</sup> that the longer supplement time (150 mg daily for 5 weeks) can increase fat-free mass, muscle strength, and size. Moreover, *E. longifolia* has been reported to have aphrodisiac property due to its ability to stimulate the production of androgen hormones, especially testosterone.<sup>[70]</sup> It is a well-known fact that the use of testosterone to enhance athletic performance is prohibited in sports.<sup>[71]</sup> Chen *et al.*<sup>[71]</sup> studied a total

of 13 male recreational athletes (age  $29 \pm 5.5$  years) who consumed either 400 mg of *E. longifolia* or placebo daily for 6 weeks. They reported that the urinary testosterone: Epitestosterone ratio of the *E. longifolia* supplement group was below the cutoff point by the International Olympic Committee Medical Commission. In addition, this plant supplementation regimen did not result in any adverse effects on the liver and renal functions of the participants.

## Antistress property

Talbott *et al.*<sup>[46]</sup> assessed stress hormones and mood state in 63 subjects (32 men and 31 women) screened for moderate stress who were supplemented with a standardized hot water extract of *E. longifolia* root or placebo for 4 weeks. They reported that the *E. longifolia*-treated group showed a significant improvement by decreased tension ( $-11\%$ ), anger ( $-12\%$ ), and confusion ( $-15\%$ ). They also showed significant improvements in stress hormone profiles via reduced cortisol ( $-16\%$ ) and increased testosterone ( $+37\%$ ). These researchers thus concluded that daily supplementation with this plant may be an effective approach to shielding the body from detrimental effects such as the stress of dieting, sleeplessness, and exercise training.

## CONCLUSION

*E. longifolia* may have sufficient evidence that elicit benefits on endurance performance and physiological responses in high dosage and longer supplementation. However, this herb has shown to have psychological aid such as antianxiety properties. Hence, further studies could also focus on the herb’s effects on psychological states and determine if these effects are associated with an improvement in exercise performance. This review article has attempted to compile the new medicinal plant *E longifolia* to be one of the choices of ergogenic plants.

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## Conflicts of interest

There are no conflicts of interest.

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Thasanee Khanijou



Wannee Jiraungkoorskul

#### ABOUT AUTHORS

**Thasanee Khanijou**, is currently pursuing her B.Sc. in Biological Sciences (Biomedical Concentration) from Mahidol University International College and is anticipated to graduate by April, 2017. Her Senior Project Research Paper is centered on "The Comparative effect of *Eurycoma longifolia* and *Tiliacora triandra* using *Artemia salina* and *Tebebrio molitor* Bioassay" and is being carried out under the supervision of Dr. Wannee Jiraungkoorskul.

**Wannee Jiraungkoorskul**, is currently working as Assistant Professor in Department of Pathobiology, Faculty of Science, Mahidol University, Thailand. She received her B.Sc. in Medical Technology, M.Sc. in Physiology, and Ph.D. in Biology. Dr. Wannee Jiraungkoorskul's current research interests are aquatic toxicopathology and efficiency of medicinal herbs.