

## Review

# Phytoestrogenic property of *Labisia pumila* for use as an estrogen replacement therapy agent

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*Labisia pumila* (LP), also known as Kacip Fatimah has been used by Malay women for generations for conditions related to menopausal symptoms. Though, there has been no scientific-based evidence for its efficacy as an estrogen replacement therapy (ERT), LP's use continues to be on the rise. This could be seen with increase in commercially available supplements which claims that taking the pills can help eliminate menopausal symptoms. To date, most researches only show us the difference in LP's effect on certain metabolic activities with that of non-treated or estrogen-treated. However, the mechanism which brought about such changes is still unknown. This is because the pathways which are affected by LP or the cross-talk with other estrogenic pathways are still unknown. Perhaps in future, these are areas in which research on LP could be focused on.

**Key words:** *Labisia pumila*, Kacip Fatimah, traditional medicine, estrogen replacement therapy.

## INTRODUCTION

*Labisia pumila* (LP), from the family of Myrsinaceae, is a sub-herbaceous shrub that is found to be growing wildly on the forest floor of peninsular Malaysia. In Malaysia, it is known locally as "Kacip Fatimah" and has been used by Malay women for generations. Traditionally, the plant will be boiled, either alone or in decoction with other herbs before being consumed (Burkill, 1935). According to Stone (1998), there are three varieties of Kacip Fatimah that exist in Malaysia: LP var. *Alata* (LPva), LP var. *Lanceolata* (LPvl) and LP var. *Pumila* (LPvp) (Figure 1). They are distinguished from each other by their petiole and leaf characteristic as well as their usage (Karimi et al., 2011). LPva, LPvl and LPvp have a winged red vein petiole, long and non-winged petiole and marginate petiole with ovate leaf blade shape, respectively (Stone, 1988). LP products are available commercially as health supplements to alleviate menopausal symptoms, such as

hot flushes and night sweats. These menopausal symptoms occur due to lack of estrogen (Liu et al., 2001) in the body and explain why women undergo estrogen replacement therapy (ERT) (Norhaiza et al., 2009).

## PHYTOESTROGENICITY OF LP

Due to LP's exclusive use in women for applications related to ERT, it has long been speculated that they exhibit phytoestrogenic activity. Phytoestrogens were postulated to have a pair of hydroxyl group and a phenolic ring which is required for binding to the estrogen receptors (ER) (Mense et al., 2008). As reported by Husniza, (2002), water extract of LP could inhibit estradiol (E<sub>2</sub>) binding to antibodies raised against E<sub>2</sub>, showing similar effect as estrone and estriol. On the other hand, Jamal et al. (2003) found out that ethanol extract of LPva root exhibits a weak estrogenic activity at 10 to 50 mg/ml in an *in vitro* assay in Ishikawa cells, but none was observed from the leaf extract. Interestingly, no activity was seen in the aqueous extract from the same roots (Jamal et al., 2003). To date, no one had attempted to study the bioactive components of LP.

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**Abbreviations:** LP, *Labisia pumila*; ERT, estrogen replacement therapy.



**Figure 1.** *LPvp* (Herbarium Laboratory, Biological Schools, Universiti Sains Malaysia).

This warrants a more in-depth analysis, particularly, using biochemical assays in the hope to identify novel bioactive compounds. The wide spectrum of activities exhibited by *LPva* was believed to be due to the flavonoids and phenolic contents extracted in water and organic solvents (Norhaiza et al., 2009; Chua et al., 2011). Both flavonoids and phenolics have remarkable pharmacological activity example anti-inflammatory, anti-oxidant and anti-cancer activity (Norhaiza et al., 2009; Chua et al., 2011; Karimi et al., 2011; Fazliana et al., 2011). *LPva* extract also induces apoptosis and reduces bacterial load of *Escherichia coli* in urinary tract infections of postmenopausal women and thus has apoptosis-inducing activity (Fazliana et al., 2011). Besides that water extract of *LP* has also been reported to have anti-photoaging activity on human dermal fibroblasts by protecting them from cell damage caused by ultraviolet (UV) irradiation (Choi et al., 2010). The estrogenic activity may differ based on the different classes of flavonoids, phenolic content, the variety and anatomy of *LP* plant. Nevertheless, total phenolics and flavonoids were found

to be the highest in the leaf extract and the lowest in the stem. Karimi et al. (2011) reported that the leaf extract of *LPva* has the highest amount of phenolics, while leaf extract of *LPvp* has the highest levels of flavonoids.

Till present, there are limited journals published in the area of evaluating *LP*'s estrogenicity, mode of action, efficacy and toxicity levels, as well as its possible interactions with other compounds. This is because the mechanism pathway which results in the physiological or metabolic change is still unknown. In spite of the lack of pharmacological data, there is an increase in commercially available *LP* supplements (Ezumi et al., 2006). It is of utmost importance for the pharmacokinetics of these supplements to be thoroughly studied with details on the half maximal efficacy concentration ( $EC_{50}$ ), half maximal inhibitory concentration ( $IC_{50}$ ) or median lethal dose ( $LD_{50}$ ) and its possible side effects. Thus, it is important to first evaluate the bioactive compound for toxicology studies on a molecular level. At present, our main focus is to elucidate the bioactive compound through the binding assays and detection of signaling molecules.

#### PHYTOESTROGENS AS ESTROGEN REPLACEMENT THERAPY

Menopause has been associated to menopausal symptoms, decreased uterine weight, increased cardiovascular risk and osteoporosis (Umland et al., 2000) and thus, ERT aims to overcome these symptoms. There are various types of ERT available commercially which range from pills, cream to gel.

All these contain estrogen in the form of micronized  $E_2$ , conjugated equine estrogen (CEE) and esterified estrogen (NIH, 2005). CEE, which is a complex natural urinary extract of pregnant mare's urine, is the most commonly used form of estrogen (Bhavnani, 2003). Bioassays and ER binding studies indicate that all estrogens in CEE are biologically active and can interact with recombinant human ER- $\alpha$  and ER- $\beta$  (Bhavnani, 2003).

In 2002, Women's Health Initiative Investigators reported that prempo (a synthetic drug), contains CEE and had resulted in an increased risk of breast cancer, coronary heart disease and stroke, which lead to the termination of a long term clinical trial. These side effects are one of the reasons why dietary phytoestrogens are being promoted as an alternative to synthetic estrogens (Liu et al., 2001; Chlebowski et al., 2003; Overk et al., 2005).

There are also more women who prefer natural approaches to overcome menopausal symptoms (Glazier and Bowman, 2011). Phytoestrogens are divided into various classes that include isoflavones, lignans, coumestans, and stilbenes (Rice and Whitehead, 2006). Epidemiologic data showed strong associations between diets high in foods containing phytoestrogens and a reduction in cardio-vascular disease and

menopausal symptoms (Umland et al., 2000), although, the beneficial effects observed are unique to the Asian population (Glazier and Bowman, 2011). For example, red clover isoflavones (40 mg/day) increases arterial elasticity and improves cardiovascular health (Xu et al., 1998). Meanwhile, genistein and daidzein (soy phytoestrogens) were shown to reverse bone loss in ovariectomized (OVX) rats (Arjmandi et al., 1998). At present, there is little research in humans and the most positive evidence of phytoestrogen came from *in vitro* or animal studies (Glazier and Bowman, 2011).

### **LP AS A POTENTIAL ESTROGEN REPLACEMENT THERAPY**

Research using animal models indicated that *LP* at a dose of 17.5 mg/kg/day could maintain elastic lamellae architecture of OVX rat aorta in a manner similar to ERT and thus, showed a possible role in modulating postmenopausal cardiovascular risks (Al-Wahaibi et al., 2008). In a separate study, both ERT and *LP* (50 mg/kg/day) were shown to suppress weight gain in OVX rats by increasing plasma leptin and decreasing resistin levels in OVX rats (Fazliana et al., 2009), but was not observed in polycystic ovary syndrome (PCOS) rats. In a later study, 17.5 mg/kg *LP* and 64.5 µg/kg E<sub>2</sub> failed to prevent weight gained induced by OVX (Shuid et al., 2011), which was also opposite to the findings of Fazliana et al. (2009). Mannerås et al. (2010) showed that *LP* at 50 mg/kg/day in dehydrotestosterone (DHT)-induced PCOS rats resulted in the opposite effect of increased resistin and decreased mRNA leptin levels, resulting in increased uterine weight. It has been suggested that the different results observed could be due to the different rat models used as *LP* could have acted through different estrogenic mechanisms in both models (Mannerås et al., 2010). However, to date, no study has been done to access the different estrogenic or non-estrogenic mechanisms of *LP* between the different rat models. If *LP* works through estrogenic pathways, increase in resistin level is consistent with *in vitro* studies of adipocytes showing that E<sub>2</sub> stimulates resistin gene expression (Chen et al., 2006). Besides increase in resistin, another similarity between *LP* and E<sub>2</sub> is the decrease in insulin sensitivity in the OVX and PCOS rats (Gonzales et al., 2002; Manneras et al., 2010). On the other hand, a down-regulation of 11 beta-hydroxysteroid dehydrogenase 1 and corticosterone protein levels in both the liver and adipose tissue (Fazliana et al., 2012) were seen.

In the aforementioned studies, *LP* displayed biological effects similar to that of ERT (Ma et al., 2010) and thus demonstrates the potential of *LP* as a natural ERT. Though, *LP* had been claimed to treat menstrual irregularity and function as a post-partum medication (Fazliana et al., 2011), and there is an increasing

evidence for the beneficial effects of phytoestrogens, but it is still too early to recommend the use of *LP* over conventional ERT as the benefits of taking traditional ERT far outweighs that of phytoestrogen consumption (Umland et al., 2000). Also, there is no evidence to conclude that *LP* could reduce menopausal symptoms, cardiovascular or osteoporosis risk. Findings at present do not show the mechanism in which *LP* can act similar to an ERT agent example same signaling pathways or downstream molecular targets. Nonetheless, all these studies have contributed to the limited knowledge on *LP* activity. In order to better understand the result seen in these studies, the mechanism of action for *LP* and the pathways in which it affects have to be identified and compared to that of ERT. *LP* may have a complex mechanism of action, working through hormone-dependent or hormone-independent pathways (Setchell, 1998). In cases where *LP* did not react similarly to estrogen, it could be due to the collection of compounds present in the crude extract. In order to evaluate the possible relation between these compounds, intensive study on the phytochemistry of *LP* and its active compound is required. Overall, data on the estrogenic actions of phytoestrogens are perplexed by many factors, such as the dosage, presence of endogenous estrogens, ages of the subjects and treatment regimes.

### **CONCLUSION**

Although, we acknowledge that *LP* is a popular herb among the Malays in Malaysia, continuous increase in commercial *LP* supplements enables it to open its market to non-Malays in the country. However, despite their widespread use and increasing acceptance, there are limited data on its efficacy as an ERT. Without knowing the components of *LP* and the active component with or without E<sub>2</sub> activity, it would be difficult to perform a comprehensive study on *LP*.

We believe that *LP* should to be subjected to a detailed pharmacological investigation for it to gain widespread acceptance as a natural ERT. Nevertheless, we hope to identify the pure active compound from *LP* that could potentially be used as a natural ERT and to facilitate the identification of pharmacological activities, example in identifying the pathways leading to the metabolic activities observed and possibility of cross-talk between *LP* and E<sub>2</sub> pathways. Overall, we would highlight that this notion is the best way in identification of novel bioactive compounds in *LP* in the effort to create a natural ERT to decrease the side effects from synthetic ERT drugs.

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## REFERENCES

- Al-Wahaibi A, Nazaimoon WMW, Norsyam WN, Fariah HS, Azian AL (2008). Extract of *Labisia pumila* var. *alata* on aorta of ovariectomized *Sprague Dawley* rats. *Pak. J. Nutr.* 7: 208-213.
- Arjmandi BH, Birnbaum R, Goya NV, Getlinger MJ, Juma S, Alekel L, Hasler CM, Drum ML, Hollis BW, Kukreja SC (1998). Bone-sparing effect of soy protein in ovarian hormone-deficient rats is related to its isoflavone content. *Am. J. Clin. Nutr.* 68: 1364S-1368S.
- Bhavnani BR (2003). Estrogens and menopause: pharmacology of conjugated equine estrogens and their potential role in the prevention of neurodegenerative diseases such as Alzheimer's. *J. Steroid Biochem. Mol. Biol.* 85(2-5): 473-482.
- Burkil IH (1935). Dictionary of economic products of the Malay Peninsular. Crown Agents of the Colonies, London, England, 2: 1290.
- Chen YH, Lee MJ, Chang HH, Hung PF, Kao YH (2006). 17 Beta-estradiol stimulates resistin gene expression in 3T3-L1 adipocytes via the estrogen receptor, extracellularly regulated kinase, and CCAAT/enhancer binding protein-alpha pathways. *Endocrinology*, 147: 4496-4504.
- Choi HK, Kim DH, Kim JW, Ngadiran S, Sarmidi MR, Park CS (2010). *Labisia pumila* extract protects skin cells from photoaging caused by UVB irradiation. *J. Biosci. Bioeng.*, 109: 291-296.
- Chua LS, Latiff NA, Lee SY, Lee CT, Sarmidi MR, Aziz RA (2011). Flavonoids and phenolic acids from *Labisia pumila* (Kacip Fatimah). *Food Chem.*, 127: 1186-1192.
- Ezumi WMF, Amrah SS, Suhaimi A, Mohsin S (2007). Evaluation of the female reproductive toxicity of aqueous extract of *Labisia pumila* var. *alata* in rats. *Indian J. Pharmacol.*, 39: 30-32.
- Fazliana M, Nazaimoon WMW, Gu HF, Ostenson CG (2009). *Labisia pumila* extract regulates body weight and adipokines in ovariectomized rats. *Maturitas*, 62: 91-97.
- Fazliana M, Ramosa NL, Luthjea P, Sekikubo M, Holm A, Nazaimoon WMW, Braunera A (2011). *Labisia pumila* var. *alata* reduces bacterial load by inducing uroepithelial cell apoptosis. *J. Ethnopharmacol.*, 136(1): 111-116.
- Fazliana M, Gu HF, Ostenson CG, Yusoff MM, Nazaimoon WMW (2012). *Labisia pumila* extract down-regulates hydroxysteroid (11-beta) dehydrogenase 1 expression and corticosterone levels in ovariectomized rats. *J. Nat. Med.*, 66(2): 257-264.
- Glazier MG, Bowman MA (2001). A review of the evidence for the use of phytoestrogens as a replacement for traditional estrogen replacement therapy. *Arch. Intern. Med.*, 161(9): 1161-1172.
- González C, Alonso A, Grueso NA, Esteban MM, Fernández S, Patterson AM (2002). Effect of treatment with different doses of 17-beta-estradiol on the insulin receptor. *Life Sci.*, 70: 1621-1630.
- Husniza, H (2002). Estrogenic and Androgenic Activities of Kacip Fatimah (*Labisia Pumila*). Abstracts of Research Projects, Kuala Lumpur. Institute of Medical Research, Ministry of Health Malaysia, 8.
- Jamal JA, Houghton PJ, Milligan SR, Ibrahim J (2003). The estrogenic and cytotoxic effects of the extracts of *Labisia pumila* var. *alata* and *Labisia pumila* var. *pumila* in-vitro. *Malays J Health Sci.*, 1: 53-60.
- Karimi E, Jaafar HZE, Ahmad S (2011). Phenolics and flavonoids profiling and antioxidant activity of three varieties of Malaysian indigenous medicinal herb *Labisia pumila* Benth. *J. Med. Plants Res.*, 5: 1200-1206.
- Liu J, Burdette JE, Xu H, Gu C, van Breemen RB, Bhat KP, Booth N, Constantinou AI, Pezzuto JM, Fong HH, Farnsworth NR, Bolton JL (2001). Evaluation of estrogenic activity of plant extracts for the potential treatment of menopausal symptoms. *J. Agric. Food Chem.*, 49(5): 2472-2479.
- Ma H, Chung MH, Lu Y, Nishihara T, Hattori M (2010). Estrogenic effects of the herbal formula, menoprogen, in ovariectomized rats. *Biol. Pharm. Bull.*, 33: 455-460.
- Mannerås L, Fazliana M, Nazaimoon WMW, Lönnd M, Gub HF, Östensonb CG, Stener-Victorina E (2010). Beneficial metabolic effects of the Malaysian herb *Labisia pumila* var. *alata* in a rat model of polycystic ovary syndrome. *J. Ethnopharmacol.*, 127: 346-351.
- Mense SM, Hei TK, Ganju RK, Bhat HK (2008). Phytoestrogens and breast cancer prevention: possible mechanisms of action. *Environ. Health Perspect.*, 116(4): 426-433.
- National Institute of Health (2005). National Heart, Lung and Blood Institute. Facts about menopausal hormone therapy. [http://www.nhlbi.nih.gov/health/women/pht\\_facts.pdf](http://www.nhlbi.nih.gov/health/women/pht_facts.pdf)
- Norhaiza M, Maziah M, Hakim M (2009). Antioxidative properties of leaf extracts of a popular Malaysian herb, *Labisia pumila*. *J. Med. Plants Res.*, 3: 217-223.
- Setchell KDR, Nechemias-Zimmer L, Cai J, Heubi JE (1998). The isoflavone content of infant formulas and the metabolic fate of these phytoestrogens in early life. *Am. J. Clin. Nutr.*, 68: 1453S-1461S.
- Shuid AN, Ping LL, Muhammad N, Mohamed N, Soelaiman IN (2011). The effects of *Labisia pumila* var. *alata* on bone markers and bone calcium in a rat model of post-menopausal osteoporosis. *J. Ethnopharmacol.*, 133: 538-542.
- Stone BC (1988). Notes on the Genus *Labisia* Lindl. (Myrsinaceae). *Malayan Nature J.*, 42: 43- 51.
- Umland EM, Cauffield JS, Kirk JK, Thomason TE (2000). Phytoestrogens as therapeutic alternatives to traditional hormone replacement in postmenopausal women. *Pharmacother.*, 20(8): 981-990.
- Writing Group for the Women's Health Initiative Investigators (2002). Risks and Benefits of Estrogen Plus Progestin in Healthy Postmenopausal Women. Principal Results From the Women's Health Initiative Randomized Controlled Trial. *JAMA.*, 288(3): 321-333. doi: 10.1001/jama.288.3.321.
- Xu X, Duncan AM, Merz BE, Kurzer MS (1998). Effects of soy isoflavones on estrogen and phytoestrogen metabolism in premenopausal women. *Cancer Epidemiol. Biomarkers Prev.*, 7: 1101-1108.