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A REVIEW BY CLITOREA TERNATEA

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ABSTRACT

Clitorieaternatea (CT) is an herbal plant that has the potential as a therapeutic agent to manage polycystic ovarian syndrome (PCOS). CT has antioxidant and anti- inflammatory properties that can help reduce inflammation, oxidative stress, and metabolic dysfunction associated with PCOS. In this study, we conducted a systematic review of relevant research articles on the bioactivity potential of CT as a herbal drug candidate for PCOS. We searched research articles in Indonstian and English published our the last five years (2019-2023) through three databases., PubMed, Science Direct, and Google Scholer. We use established inclusion and exclusion criteria to select suitable articles. Out of 24 research articles included in our systematic review, We found that CT has potential as an antidibatic, antiglucose, anticholesterol, antiobesity, anti-inflammatory, hepatoprotective, and antidepressant agent. Based on our systematic review, CT shows potential as a therapeutic agent for managing PCOS symptoms. The antioxidant and anti-inflammatory propertis of CT can help reduce inflammation, oxidative stress, and metabolic dysfunctions associated with PCOS. However, further research is needed to validate these finding and evaluate the effectiveness of CT in clinical settings.

KEWORDS: Bioactivity; clitorea ternatea; herbal drug; polycystic ovary syndrome; pharmacology; pharmacognosy.

INTRODUCTION

PCOS (Polycystic ovary syndrome) is a hormonal sickness that impact ladies of reproductive age. It is characterised by irregular menstrual cycles, high levels of androgens (male hormones), and the development of small cysts on the ovaries (aflatounian et al., 2020). PCOS can lead to varies health problems, including infertility, insuline resistans, obesity, chronic inflammation, and metabolic disordes. This conditions can increases the risk of cardiovascular diseases, heart disease, strock and liver damage (Vanky and lo\vvik, 2020) the use of certain medications for PCOS treatment can also have side effects on liver health. Therefor, finding effective solution to manage PCOS and its associated complications is crucial (Gard and Teed, 2020).

Fig. PCOS (Polycystic ovary syndrome).

Clitorea ternatea, also know as butterfly pea flower, has been studied for its potential therapeutic effects in PCOS. It contains compounds such as flavonoids, alkolies saffonies and tannins (gejalakshmi. S and Harikrishna, 2023), which have antioxidants and anti-inflammatory properties (wang et al., 2022). Studies have shown that clitoreternatea extract can inhibit the production of pro-inflammatory cytokines, reduce oxidative stress, and protected against liver and kidney damage. It may also help regulate lipid, metabolism, lower cholesterol level, and improve insuline sensitivity (Hakam Maulidy et al., 2022).

PCOS is a complex hormonal disorder that involve inflammation, oxidative stress, and metabolic dysfunction. Clitoreaternatea, with its antioxidants and anti-inflammatory

properties, shows promise as a potential therapeutic agent for managing PCOS symptoms (Goh et al., 2021 a; Widowati et al., 2023). Further research is need to fully understand its mechanisms of action and determine its efficacy in clinical settings.

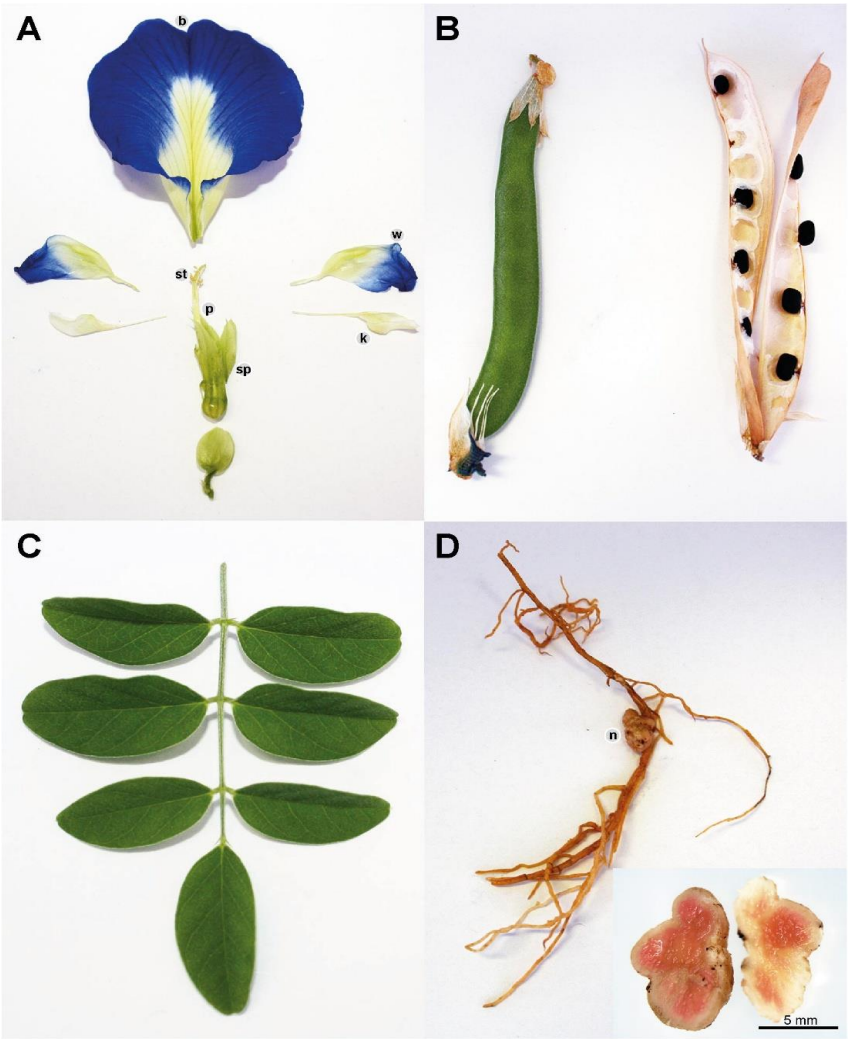
Inflammation and oxidative strain a substantial function within side the improment and development of PCOS. Chronic low grade irritation can disrubt the improment of ovarian follicals and intervial with ovulation. It can also contribute to insulin resistance, which further exacerbates the hormonal imbalance in PCS. Oxidative stress, which take place whilst there and imbalance among the manufacturing free radicals and the bodies antioxidative diffences, can damage ovarian, and impair follical development. It can also contribute to the formation of ovarian cysts and increase the risk of complication associated with PCOS (armanini et al., 2022; bacr et al 2022). Recent research has also explored the role of glute microbiota in PCOS. Disruption of the gult microbiota balance, known as dysbiosis, can affect hormonal regulation and contribute to inflammation and metabolic dysfunction (zhang et al 2022.) clitoreaternatea extract has shown potential in modulating glute microbiota and improving overall hormonal balance (Liayang et al 2020).

Fig. Clitorea ternatea.

MATERIALS AND METHODS

Research articals were searched use in three database, namely PubMed, science directed google scholra in (2019–2023) a publication and written in Indonesian and English. The keywords used in the articals such having mached to medical subject titles (NeSH) including "Apple flowers, "butterfly pea, "Asian pigeoning "(t\n: clitoreaternetea " antidiabetic ", anti glucose ",cholesterol regulative ",anti-inflammatory "," hepatoprotective ", "antidepressant ", according to PICOTs (population, intervention, comparators, outcomes, times).

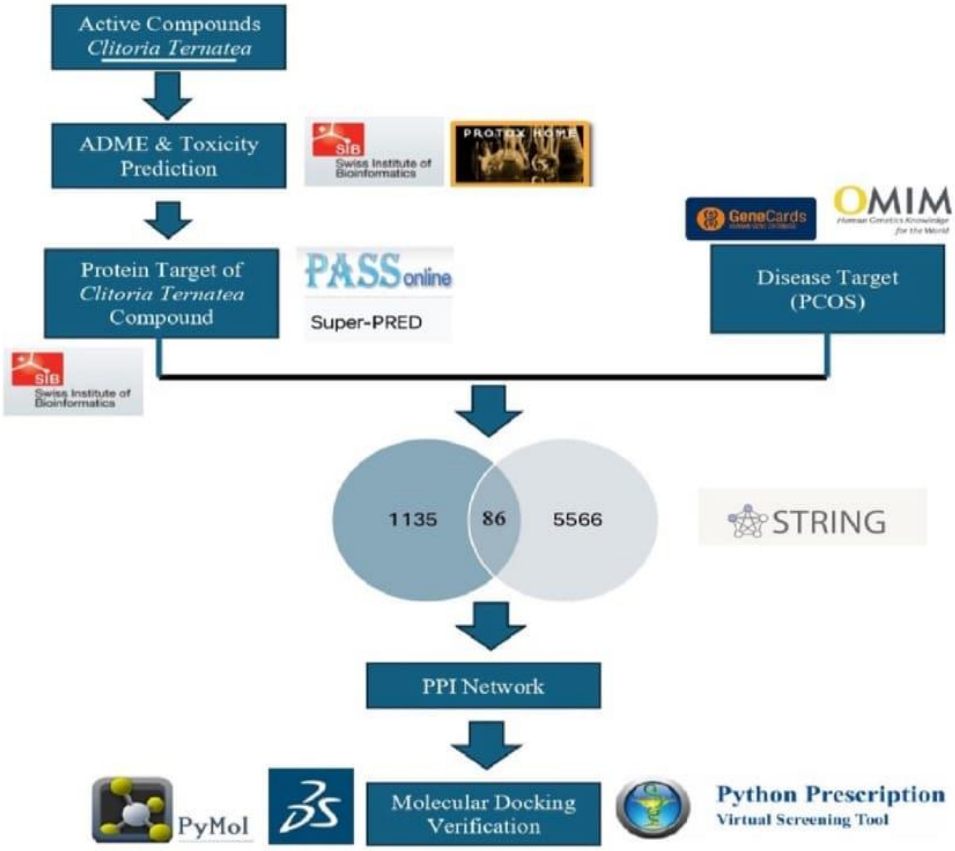
Material and methods for study clitoria ternetea and its potential effects on polycystic ovary syndrome (PCOS) generally fall into three categories; in silico (computational) studies, in vitro (sell -based) studies, and in vivo (animal) studies. As of late 2024, most research on C. ternetea PCOS is still in the preclinical computational or animal modal stage, with no documented human clinical trials specifically on this topic.



Methods for studying clitorea ternatea in PCOS models

1. In silico (computational) studies

Purpose; to predict the potential C. ternatea compound to modulate key receptors involved in PCOS, such as the androgen receptor (AR) and follical stimulating hormone receptor (FSHR).



METHODOLOGY

Molecular docking; Assess the binding affinity and interaction profile between selected compounds from C. ternatea (e.g., cyanidin, baicalein, malvidin) and target protein (e.g., AR, FSHR).

Molecular dynamics simulation: Conduct simulations to evaluate the stability of the compound – protein complex.

Binding affinity analysis; Use software like AutoDock Vina and PyRx to calculate binding energies and predict potential therapeutic effects.

2. In vitro (cell culture) studies

Purpose; To evaluate the anti – PCOS potential of C. ternate extracts on specific cellular mechanism, such as hormone receptor activity or antioxidant effects.

METHODOLOGY

Cell lines; Use relavant human cell lines, such as human breast cancer cell lines (MCF – 7), to evaluate anti – estrogenic activity.

Assays

Anti – estrogen activity; Conduct an MTT assay to measure the concentration of extract required to inhibit cell growth (IC50).

Antioxidant activity; use assays such as DPPH (2,2 – diphenyl – 1-picrylhydrazyl), superoxide scavenging, and lipid peroxidation to measure antioxidant properties.

3. In vivo (animal) studies

Purpose; To validate the therapeutic efficacy of C. ternatea extract on PCOS – related symptoms in living animal models.

METHODOLOGY

Animal models; Use rodents, such as female mice or rates with chemically induced the PCOS. Common induction agents include letrozole or dehydroepiandrosterone (DHEA). Male models can also be used to study androgenic effect.

Treatment

Administer C. ternatea extract orally (e.g., via gavage) at specific concentyrations (e.g., mg \ kg body weight) for a set duration (e.g., several weeks).

Include control groups (untreated PCOS model) and standard drug groups for comparison.

Evaluations;

Hormonal analysis; measure plasma levels of hormones relevant to PCOS, including luteinizing hormone (LH), follicle - stimulating hormone (FSH),and testosterone.

Histopathology; examine ovarian tissues to assess the number of ovarian follicles, cystic follicles, and corpora lutea.

Metabolic parameters; assess changes in insulin resistance, lipid, metabolism (cholesterol levels), and body weight.

Oxidative stress and inflammations

Measure biomarkers for oxidative stress (e.g,. malondialdehyde) and inflammation.

Material preparation

Plant Material

Collection; harvest fresh flower of clitoria ternetea, ensuring they are free of disease. record the collection date, time, and location for authentication, a plant sample is typically retained in a university herbarium and a sign and accession number.

Drying; wash the flowers and dry them using one of these methods

Air- drying: Shade-dry the flowers for several days at a room temperature.

Freeze – Drying: Grind freeze – dried flowers for higher preservation of bioactive compounds, particularly anthocyanins.

Grinding: Mill the dried flowers into a fine powder using a mechanical grinder.

Extraction

Solvents: Researchers use various solvents to create extracts, each targeting different bioactive compounds. Common solvents include;

Ethanol (96% or 80%)

Methanol

Water

Methods

Maceration: Soak the powdered flowers in the solvents for and extended period (e.g, 45 days for methanolic extract) with occasional shaking.

Soxhlet exaction : use a Soxhlet apparatus for successive solvent extraction.

Ultrasonic – assisted extraction : use as ultrasonic bath to improve extraction and preserve sensitive compounds.

Concentration; filter the extracted mixture to remove plant debris. Concentrate the crude extract use in a rotary evaporator under low pressure and moderate temperature (e.g 40oC). Further drying may occur in a fume hood.

Active compound isolation

To investigate specific mechanism, researchers may isolate and purify specific compounds, such as flavonoids (anthocyanins, cyanidin, etc.) or alkaloids, from the crude extraction.

Effect of clitorea ternatea on PCOS – molecular ducking study

Polycystic ovarian syndrome is a heterogeneous disorder. It is the most common endocrinopathy in human and a most common cause of anovulatory infertility. International guidance for the accecetment and management of polycystic ovarian syndrome – 2018 reported that one in ten women are PCOS and 8-30 % of reproductive – aged women are affected by PCOS with up to 70 % of affected women remanning undiagonist.

OBJECTIVE

1. This study aim to find the role of quercetin, myricetin, and kaempferom in treating PCOS.
2. Virtual screening (target- based drug desinging) this flavonnoid opf clitorea ternatea with used a as ligands to identify the patented inhibitor of the CYP 70 enzyme.
3. Control drug such as citoconazole, spironolactone, and flutamide was also explored to find efficiency of flavonoids in treating PCOS.

MATERIALS AND METHODS

Identification of clitorea ternatea

For identification of an taxonomical, the herbalium of clitorea ternatea was prepared by using herbalium techniques such as collection, presing drying, mounting, labling and filling.

Sr no	Parameter	Yes	No	No of respondents (n)
1.	Habit of taking daily breakfast	964 (88.5%)	125 (11.5%)	1089
2.	Following balanced died	569 (52.6%)	513 (47.4%)	1082
3.	Undergoing regular heath check-up	334 (30.7%)	754 (69.3%)	1088
4.	Aware of heath risk of wrong life style	333 (91.7%)	90 (8.3%)	1089
5.	Self modification being done on died pf lifestyle	815 (74.8%)	274 (25.2%)	1089
6.	Have ever flailed the need of a personal naritionnist \ diatetian ?	536 (49.2%)	553 (50.8%)	1089
7.	Having a guidance to plane self nutritional goals	470 (43.2%)	617 (56.8%)	1087

FORMULATION OF NUTRSCEUTICAL PRODUCY

Fresh purple CITY flower were collected and air dried for four days. Dried flowers were ground well into a fine powered and seived to remove large particals. Then 500 mg of dried powered was filled in the 500 mg mt vegetarian capsule.

NUTRIANT ANALYSIS

Dried clitorea ternatea flowers were analyzed for essential nutrients like moisture, total ash, calcium, potassium, magnesium, total flavonoids.

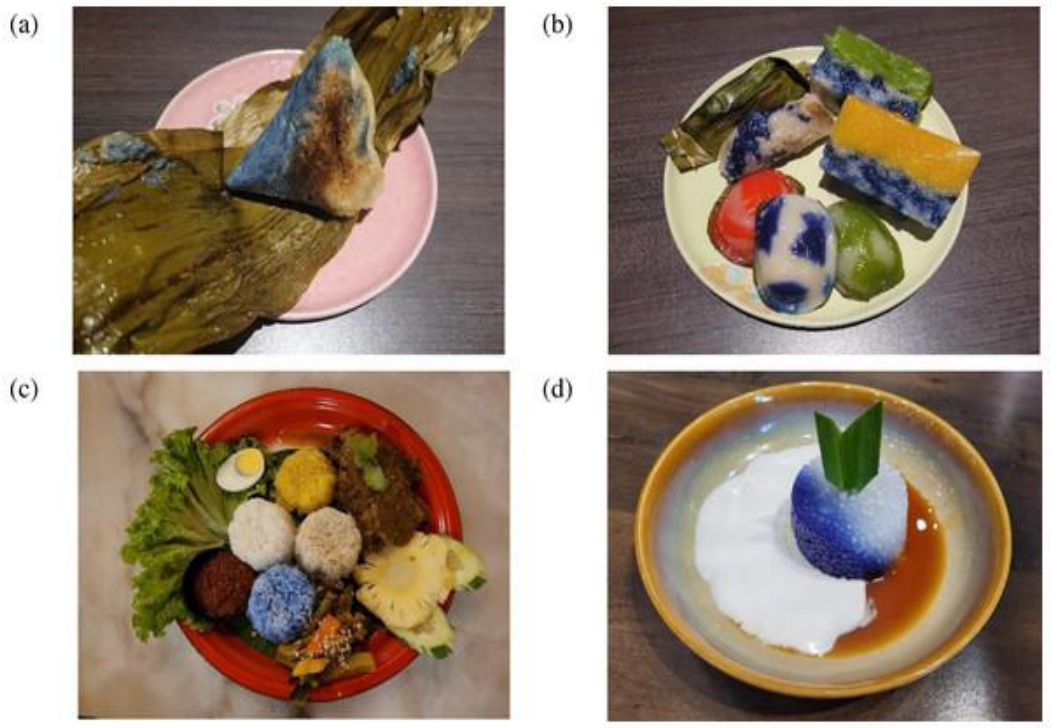


Figure.

MOLECULAR DOCKING

Molecular binding affinity was explored with the help of PyRx. The binding affinity of flavonoids such as quericetin, kaempferol, and mirycetin is present in the petals of clitorea ternatea were explored with the protein CYP 17 – cytochrome P450 (which is responsible for PCOS and leads to hyperandrogenism). The binding affinity of ketoconazole, spironolactone, flutamide (are all used as drugs for treating hyperandrogenism) were also explore with the protein CYP 17 - cytochrome P450 to compare the efficiency of flavonoids in the treatment of PCOS.

Table 1: Nutrient Compositin of Poweder of Dired C.T. Flowers.

Parameters	Dried C.T flower
Moisture (g)	93.4
Total ash (%)	6
Calcium (mg \ 100 g)	445.8
Magnesium (mg \ 100 g)	811.2
Potassium (mg \ 100 g)	143.5
Total flavonoids (mg QE\g)	102

Table 2: Binding Affenity Score of Phytochemical Present In C.T Flower.

Phytochemical name;	CID;	Binding energy (Kcal \ mol)
Quercetin	44258003	-7.9
kaempferol	5280863	-7.7
Myricetin	44259462	-10.7

Table 3: Binding Affenity of Control Drug.

Drugs name	CID	Binding Energy (Kcal \ mol)
Ketoconazole	456201	-7.7
Spironolactone	5833	-7.8
Flutamide	5397	-6.6

POTENTIAL OF CLITOREA TERNATEA AS A PCOS INSULINE SENTITIZER AGENT

Clitorea ternatea has several mechanism that can reduce in the body. One such mechanism is thought the inhibition of formation of advanced glycation end products (ages), which are main of pathways ready to diabetis complication. Water extract and ethanol extract have been shown in vitro to inhibit the formation of AGEs by reducing thr protein carbonyl contained and preventing the deployment of thiayol protein (indiryat et al., 2022). Clitorea ternatea has been shown to have potential in increasing insulin sensitivity. C. ternatea flower extract contained active compound that can inhance the expression of genes associated with insulin sensitivity, such as PPAR 4 Glut 2, Tcf 712 and Capn 10, in edition, c. ternatea can also reduce hyper insulin – related inflammation by reducing the MCP1 gene expression. This mechanism helps improve the bodies ability to use insulin and regulate blood glucose level (indiryat et al 2022).

Flavonoids compounds in butterfy pea that can protect sells from hyper gyicemic stress. Flavonoids can prevent further decrease in NAD + and NADH levels pyridin – 1 over activation. In addiction, flavonoids also have antioxidant properties that can reduce the adverse effect of oxidative stress. With this mechanism, C. ternatea can help lower blood glucose level in rats with metabolic syndrome (gunvan et al 2023). Protein extract from C. ternatea have been shown to inhibitory activity against the a amilase enzyme, which is responsible for digesting carbohydrate into glucose. By inhibiting the activity of this enzyme, C. ternatea can help reduce the absorption of glucose from flood into the blood. C. ternatea has anti-inflammatory assosiated with insulin resistance and increase the body sensitivity to insulin (minoneko et al 2020).

C. ternatea increases the expression of insulin protein in the pancreas, reduce the activity GSK – 3b enzymes in the liver, which inhibit in the conversion of glucose to glycogen, which helps keep blood glucose level stable and potentially as a therapy for hyper insulin (vidovati et al 2023).

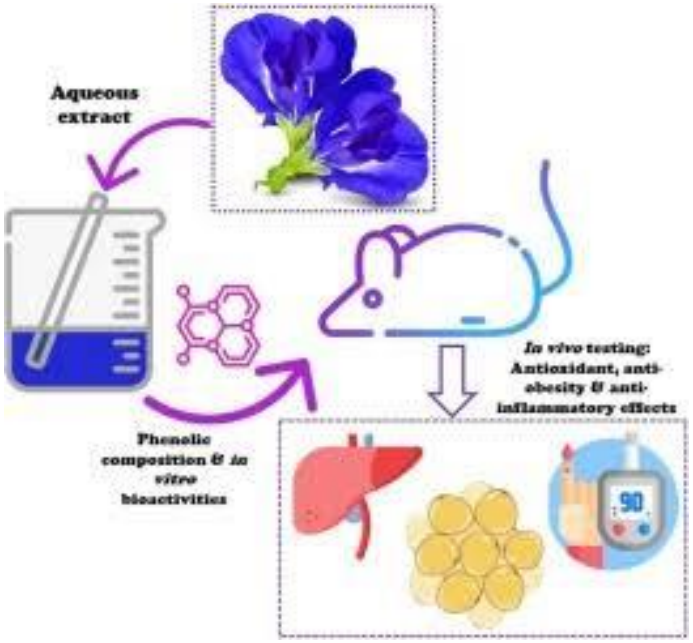


Fig. Clitorea Ternatea Blue Petal Extract Protect Against Obesity.

POTENTIAL OF CLIROREA TERNATEA AS ANTI INFLAMMATORY IN LOW – GRAD CHRONIC INFLAMMATION OF PCOS

Low – grad chronic inflammation is an inflammatory process that lasts over a long period of time, with a low, resistance rate of inflammasome reaction. Low – degree chronic inflammation can contribute to the development of disease such as diabetes, heart disease and obesity. Low – degree chronic inflammation can affect many accepts of this disorder, ovulation, insulin resistance, and ovary follical. In condition of PCOS, body sence and ovary tissuse can produce pro-inflammatory cytokines, such as interlukine – 6 (IL-6) and tumor neuchrosis factor – alpha.

(TNF-alpha) this cytokines stimulate a sustain inflammatory reaction in the ovary. Low degree inflammation can contribute to insulin resistance, which is one of the main charactersisc of PCOS. Pro-inflammatory cytokines can inhibit normal insulin sigal pathway, making the body sence less responce to, causing the body to produce more insulin to cope with high blood glucose level, which further lead to hyper inslineminia (Aboeldaly et al 2021).

Potential of clitorea ternatea on the dysbiosis mechanism of gut mioprobiota (DOGMA) PCOS microorganism in the digestive tract can affect hormone mechanism, including reproductive hormones such as estrogen. Estrogen play an important role in ovarian follical. An imbalance in the production or metabolic of estrogen due to dysbiosis can affect the hormone balance in the body and potential can affect the development of ovarian follicales. The gut microbiota affect the balance of the immune system. Inflammation cause by an improper immune response or a change of the balance of immune cell can affect the development (Liang et el 2020).

Potential of the Clitoria Ternatea on The Mechanisms of Psycho-Neuroimmunology

Psychological stress can affect the autonomic nervous system and spinal cord, which then affects the production of hormones by the adrenal glands, such as cortisol (hormone stress). High levels of cortisol due to chronic stress can affect the balance of sex hormones, including estrogen and androgen, which play a role in the development of ovarian follicles and can cause hormonal imbalances in the body. The immune system's response to psychological stress can also affect the development of PCOS. Increased inflammation caused by the activation of the immune system can contribute to insulin resistance and hormonal dysfunction associated with PCOS(Damone et al., 2019). Psychological stress can also affect eating behavior and lifestyle, such as poor diet and lack of physical activity. Unhealthy diet and unbalanced lifestyle habits can affect hormonal regulation and the immune system, as well as contribute to the development of PCOS and abnormal development of ovarian follicles(Xia & Du, 2022).

C. ternateareduce the standby time on both tests. The results of this study show that the antidepressant effect of Clitoriaternatea is mediated by increased levels of norepinephrine in the synapses, increasing the level of noradrenaline in the Synapse, which can contribute to the anti-depressive effect. C. ternatea also contains compounds such as flavonoids and triterpenoids that have antioxidant and antiinflammatory effects. These compounds can play a role in reducing oxidative stress and inflammation, which can affect the nervous system, mentality, and immune system (Margret et al., 2019; Mittal et al., 2021).

Hepatoprotective in clitoria tearnatea

Treatment for PCOS is often aimed at addressing symptoms and related health problems, such ashormonal imbalances, irregular menstrual cycles, and metabolic disorders. Regarding the long-term effects of such drugs on the liver (hepar), some of them may have side effects

that affect liver health, especially if used for a long time or in high doses. Some drugs, such as spironolactone and metformin, can cause stress on the liver and cause inflammation or liver cell damage (hepatotoxicity), therefore, it is important to monitor liver function regularly during long-term use of the drug. Some medications can cause elevated levels of liver enzymes in the blood. If this increase is significant, it could be a sign of liver problems. Antiandrogenic drugs, have been associated with an increased risk of developing NAFLD in women with PCOS. NAFLD is a condition in which fat accumulates in the liver without being caused by alcohol consumption (Guan et al., 2020; Pedersen et al., 2018).

C. ternatea can reduce liver damage caused by CCl4 by reducing levels of SGPT, SGOT, ALP, and total bilirubin in the blood, can reduce kidney damage caused by cisplatin by reducing the levels of urea and creatinine in the blood. C.ternateacontains secondary metabolites such as flavonoids and anthocyanins, which act as antioxidants and can contribute electrons to stabilize free radicals that cause liver damage. In addition, flavonoids can interfere with oxidative reactions in cells, protect cells from oxidation stress, and increase the endogenous antioxidants of the body, thereby reducing the risk of liver damage. This hepatoprotective and nephroprotective activity(Pebiansyah et al., 2022).

Modulating hormones: Clitoria ternatea may help manage hyperandrogenism by interacting with enzymes like CYP17, which is overexpressed in PCOS. In silico studies have also shown its compounds can bind to receptors such as the androgen receptor (AR) and follicle stimulating hormone receptor (FSHR), suggesting a potential for regulating hormone activity.

Reducing inflammation and oxidative stress: The plant's anti-inflammatory and antioxidant compounds can help combat the chronic inflammation and oxidative stress associated with PCOS.

Improving metabolic dysfunction: Studies suggest Clitoria ternatea may have antidiabetic, anti-obesity, and anticholesterol properties, which could help manage the metabolic issues common in PCOS.

Evidence from studies

In silico (computational) studies: Computer-based analyses have identified compounds in Clitoria ternatea that show potential for binding to key receptors like AR, FSHR, and AMHRII, suggesting a possible therapeutic effect.

Animal and in vitro studies: Some studies show C. ternatea extracts have antioxidant and anti-estrogen activities and can improve ovulation and menstrual regularity in animal models.

Pilot clinical study: A pilot study on a specific processed Clitoria ternatea formulation (Aparajita) showed it can induce ovulation, improve menstrual regularity, normalize menstrual flow, and reduce BMI without significant adverse effects.

Limitations and future research

Need for clinical trials: While initial findings are promising, there is a need for larger, controlled clinical trials to validate the effectiveness and safety of Clitoria ternatea for PCOS management.

Bioavailability and pharmacokinetics: The bioavailability and pharmacokinetic properties of some compounds need to be addressed to ensure their therapeutic potential can be realized.

Standardization: Developing standardized products and dosages is important for consistent results in clinical applications.

Advantages (Potential Benefits)

Research, primarily from in silico (computational) and animal studies, suggests the following potential advantages for managing PCOS:

Anti-inflammatory and Antioxidant Effects: PCOS involves chronic inflammation and oxidative stress. The flavonoids and anthocyanins in Clitoria ternatea can help reduce these conditions by inhibiting pro-inflammatory cytokines and fighting free radicals.

Hormonal Regulation: In silico studies suggest that compounds in Clitoria ternatea may modulate key hormone receptors involved in PCOS. These include the Follicle-Stimulating Hormone Receptor (FSHR) and the androgen receptor (AR), potentially helping to regulate hormone levels and improve folliculogenesis.

Metabolic Health Improvement: Studies indicate it may help improve insulin sensitivity, regulate lipid metabolism, and lower cholesterol levels, addressing metabolic dysfunctions often associated with PCOS.

Weight Management: Some studies suggest it can aid in weight management and reduce obesity indices, which is beneficial for women with PCOS.

Stress and Mood Management: The plant has adaptogenic properties and is traditionally used in Ayurvedic medicine as a brain tonic and to reduce stress and anxiety, which are common issues for individuals with PCOS.

Disadvantages and Limitations

Despite the potential, several significant disadvantages and limitations must be considered:

Lack of Human Clinical Data: Most findings are from computational (molecular docking) or animal studies. There is a critical lack of human intervention studies to confirm efficacy and safety in women with PCOS.

Undetermined Dosage: Without human clinical trials, the appropriate and safe dosage for human consumption in a therapeutic context remains unknown.

Potential Side Effects: While generally considered safe in moderate food amounts, excessive use may lead to nausea or stomach upset in some individuals.

Allergy and Interaction Concerns: As with any herbal product, there is a risk of allergic reactions. Its potential interaction with existing medications (e.g., antidiabetic or hormonal treatments for PCOS) has not been thoroughly evaluated.

Specific Form/Preparation: Different parts of the plant and different extraction methods (e.g., root extract vs. flower tea) may have varying effects, and the most effective preparation for PCOS is unclear.

Conclusion While Clitoria ternatea shows great promise as a potential natural therapy for PCOS, it should be approached with caution. Individuals with PCOS should consult a healthcare professional before incorporating it into their treatment plan due to the limited clinical evidence and lack of established safety guidelines and dosages for this specific condition.

Potential uses in PCOS

Ovulation induction: A pilot study found that a specific root preparation of Clitoria ternatea induced ovulation in a portion of women with anovulatory infertility (many with PCOS) and improved menstrual regularity.

Anti-inflammatory and antioxidant effects: PCOS is associated with inflammation and oxidative stress, and C. ternatea contains compounds with these properties, which may help manage some PCOS symptoms.

Hormonal regulation

In silico (computer-based) studies suggest C. ternatea compounds could modulate the androgen receptor, which is overactive in PCOS.

Research also suggests it may positively influence the anti-Müllerian hormone (AMH) and the FSHR pathway, which are important for follicle development.

Blood sugar and insulin: Some animal studies indicate that C. ternatea may help lower blood glucose levels and improve the function of pancreatic beta cells, which could be beneficial as insulin resistance is a common issue in PCOS.

Important considerations

The current research is promising but largely pre-clinical or preliminary.

The specific preparation and dosage matter; one pilot study used a unique goat milk-processed root powder.

More large-scale human clinical trials are necessary to validate these findings and establish safety and efficacy.

It is crucial to consult a healthcare provider before using C. ternatea or any other supplement for PCOS management.

CONCLUSION

Clitoriaternatea, has the potential as a potential drug candidate for PCOS. Clitoriaternatea flower extract has shown hepatoprotective and nephroprotective activity, which can help protect the liver and kidneys from damage caused by PCOS. In addition, the flower of Clitoriaternatea also has the potential to reduce insulin resistance and increase insulin sensitivity, which is a major problem in hyperandrogen PCOS. By understanding the potential of Clitoriaternatea as a potential cure for PCOS, we can develop more effective and natural therapies to deal with the problem of PCOS and prevent its complications.

In this study, a structure-based virtual screening was appliedon the flavonoids such as Quercetin, Kaempferol, and Myricetin (are present in the petals of Clitoria ternatea), and chemical drugs such as Ketoconazole, Spironolactone, Flutamide (used as drugs for treating hyperandrogenism)were explored with the protein CYP 17 -cytochrome P450 which is responsible for hyperandrogenism and leads to PCOS. The Structured Based Virtual

Screening was performed by using AutoDock VINA implicated in PyRx0.8 software. More negative binding affinity was obtained and it represents the better orientation of the ligand in the binding site. And the binding energy of flavonoids is almost similar to chemical drugs which are used for treating hyperandrogenism. By inhibiting the enzyme (CYP 17) activity androgen synthesis can be prevented in the ovary. Hence, flowers of Clitoria ternatea will be the better alternative for the prevention and treatment of Poly Cystic Ovarian Syndrome.

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