ISSN (Online) 2456 -1304

International Journal of Science, Engineering and Management (IJSEM)

Vol 10, Issue 10, October 2023

Synergistic Phytochemical Analysis of Battissa: A Traditional Herbal Formulation Enhancing Women's Postpartum Health in India

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Abstract*— Women are an integral part of society, who often struggle to meet their basic health needs leading them to turn to cost-effective and accessible traditional systems, such as home remedies and cultural beliefs. In India, traditional medicinal systems like Unani and Siddha, aligned with Ayurvedic principles, employ plant-based treatments for various ailments, offering a valuable alternative. Childbirth, a profound physiological and psychological event, poses heightened nutritional demands for lactating mothers, rendering them susceptible to illness during this critical phase. Battissa, an amalgamation of 32 medicinal plants, holds significant promise in addressing the unique postpartum health needs of women. The study aims to elucidate each component plant within Battissa, each of which exhibited diverse phytochemical and bioactive compounds with multifarious health benefits. Moreover, the study assessed total phenolic and flavonoid content, two crucial bioactive compounds known for their health-promoting properties. However, it is noteworthy that synergistic application of Battissa enhanced postpartum health benefits considered Battissa as a holistic formulation. This research contributes to a deeper understanding of Battissa, seek to bridge the gap between traditional practices and modern healthcare by providing a comprehensive scientific understanding of Battissa, promoting the well-being of postpartum women, thus contributing to the enhancement of traditional women's healthcare practices.

***Index Terms*—Battissa, Phytochemical, Postpartum.**

I. INTRODUCTION

In recent years, the scientific community has turned its attention to plants as sources of bioactive compounds with potential health benefits due to growing concerns about the side effects of synthetic antioxidants on human health. Plants have been found to contain a wide range of natural products that vary in structure, biological properties, and mechanisms of action. These bioactive properties are largely attributed to phytochemical components, including polyphenols, flavonoids, and phenolic acids, which contribute to the antioxidant activity of plants by scavenging free radicals, inhibiting peroxidation, and chelating transition metals (Nickavar et al., 2006).

Moreover, traditional medicinal systems, such as Ayurveda, offer a wide spectrum of therapies with immunomodulatory capacities, promising improved therapeutic options (Patwardhan and Gautam, 2005). Despite the widespread use of traditional medicine, especially Ayurveda, its acceptance has been hindered by the lack of scientific validation. To bridge this gap, reverse pharmacology has emerged as a valuable approach, comparing the pharmacological effects of traditional remedies with modern drugs (Xiangming et al., 2014).

Furthermore, women, who constitute a significant portion of the global population and are often the primary healthcare decision-makers for their families, are turning to complementary and alternative medicine, including herbal remedies (Kennedy, 2005). Ayurvedic formulations have been recognized for their postpartum healing and recovery benefits, addressing common issues such as postpartum depression, body aches, insomnia, and oxidative stress (Kuroda et al., 2010).

The herbal mixture known as "Battissa," composed of 32 different herbs, plays a vital role in postpartum recovery. These herbs, when combined, have diverse pharmacological properties that aid in healing and strengthening postpartum women.

The antioxidant potential of these 32 medicinal plants, primarily attributed to their polyphenolic content, has led to increased interest in their use for preventing oxidative stress-related diseases. Plant phenolics, the most abundant secondary metabolites in plants, have potent antioxidant properties and are believed to contribute to the prevention of various diseases associated with oxidative stress.

II. OBJECTIVES

This study aimed to comprehensively explore 32 medicinal plants found in Battissa, focusing on their botanical characteristics, phytochemical components, and their traditional application as a post-partum tonic in alternative Indian medicine. Additionally, the study conducted a preliminary survey to identify the presence of phenolic compounds within Battissa.

III. MATERIALS AND METHODS

Collection of samples

Battissa powder samples were sourced from Norani Dawa Khana, located in Sabzibagh, Patna, Bihar. The components

ISSN (Online) 2456 -1304
International Journal of Science, Engineering and Management (IJSEM)
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of Battissa were gathered and analyzed at the Department of Botany, Patna University, where their identification and examination were conducted. A comprehensive literature review was carried out to identify the active principles within each component, and their traditional applications were also investigated.

Determination of Total Phenolic content

A. Extract Preparation

To estimate total phenols in Battissa plant material, a methanol solvent was used. 20 grams of Battissa powder were mixed with 100 milliliters of methanol at a ratio of 1:5. This mixture was allowed to sit for 48 hours. Afterward, the mixture was filtered two times to obtain the leaf extract.

B. Estimation of Total Phenols

Total phenol content was determined using the Folin-Ciocalteau method, as described by Madaan et al. (2011). In this method, phenolic compounds in plant tissues react with phosphomolybdic acid within the Folin-Ciocalteau reagent, forming a blue complex in an alkaline environment. The concentration of total phenols was quantified by measuring the absorbance of the complex at 765nm using a spectrophotometer.

1) Preparation of Standard/Calibration curve for total phenol estimation

In this experiment, 10 milligrams (mg) of gallic acid were dissolved in 100 milliliters (ml) of a solution containing 50% methanol (resulting in a concentration of 100 micrograms per milliliter, or 100 µg/ml). This solution was further diluted to create solutions with concentrations of 10, 20, 40, 60, 80, and 100 µg/ml.

From each of these diluted solutions, a small amount (aliquot) was taken and placed in separate test tubes. Then, 10 ml of distilled water was added to each test tube, followed by the addition of 1.5 ml of Folin-Coicalteu's reagent. The mixture was allowed to incubate for 5 minutes. After incubation, 4 ml of a 20% (w/w) sodium carbonate solution was added to each test tube, and distilled water was added to bring the total volume in each test tube up to 25 ml. The contents were mixed and left to stand at room temperature for 30 minutes.

To measure the absorbance of the standard, a UV-VIS spectrophotometer was used at a wavelength of 765 nanometers (nm), and this measurement was compared against a blank, which contained only distilled water. A standard curve was prepared using gallic acid, and the results were expressed as equivalents of gallic acid in micrograms per milliliter (µg/ml) based on this calibration curve. The total phenolic content was determined using the following equation, which relies on the calibration curve:

Total Phenolic Content (µg/ml) = [Absorbance of sample - Absorbance of blank] × Slope of the standard curve

This method allows the quantification of the total phenolic content in the samples as µg/ml equivalents of gallic acid:

$$y = mx + c$$

y= absorbance,
m=slope,
x=concentration,
c=intercept

Here, x is the dependent variable and y is the independent variable.

2) Analysis of plant extract sample

1 ml of plant extract dissolved in methanol was mixed with 10 ml of distilled water in a test tube. Then, 1.5 ml of Folin-Coicalteu's reagent was added, and the mixture was allowed to sit for 5 minutes. Afterward, 4 ml of a 20% sodium carbonate solution was added to the test tube, and distilled water was added to reach a total volume of 25 ml. The mixture was stirred and left at room temperature for 30 minutes. In a separate test tube, 1 ml of leaf extract was combined with 24 ml of distilled water to create a blank solution. The absorbance of the standard solution was measured at 765 nm using a UV-VIS spectrophotometer, and this measurement was compared to the blank solution.

Determination of Total Flavonoid

Total flavonoid content in the plant sample was estimated by Dewanto et al., (2002) method.

A. Extract Preparation

0.25gm of dried powdered sample was taken and crushed in 10ml of distilled water and then filtered.

B. Estimation of Total Flavonoid

Flavonoid content was measured using a chemical test. Small amounts of the sample and a standard solution of quercetin were mixed with water and certain chemicals in test tubes. After a specific time, more chemicals were added, and the mixture turned orange-yellow. We used a machine called a spectrophotometer to measure the color intensity at a specific wavelength. We also did a test with just water to compare. We repeated these tests three times. To find the amount of flavonoids, we compared our results to a quercetin standard. We expressed the flavonoid amount as milligrams of quercetin equivalent per 100 grams of dry sample. We followed methods described by Kalita et al. (2013).

IV. RESULTS AND DISCUSSIONS

Phytochemicals are naturally occurring substances found in the medicinal plants parts viz. leaves vegetables and roots that provide defense mechanisms and protect from various diseases. Phenolic and flavonoid molecules are important antioxidant components which are responsible for deactivating free radicals based on their ability to donate hydrogen atoms to free radicals. Flavonoids are secondary metabolites with antioxidant activity, the potency of which depends on the number and position of free OH groups (Panche et al., 2016). They also have ideal structural characteristics for free radical scavenging (Amarowicz et al.,

2004). Different literature reports indicate a linear correlation of total phenolic and flavonoid content with antioxidant capacity (Shrestha et al., 2006). In addition, flavonoids are readily ingested by humans and they seem to display important anti-inflammatory, anti-allergic and anti-cancer activities (Crozier et al., 2006). It has been recognized that flavonoids show antioxidant activity and their effects on human nutrition and health are considerable.

Total Phenolic content

Phenolic compounds in plants are important due to their ability to combat harmful molecules called free radicals. These compounds have antioxidant properties. Studies have shown that the more phenolic compounds a plant has, the better it can neutralize free radicals. The Folin–Ciocalteu reagent was used to measure the number of phenolic compounds in each plant extract. The results were compared to a standard substance called gallic acid. The total phenolic content was calculated using a calibration curve ($Y = 0.011x-0.0946$; $R2 = 0.990$) and expressed as milligrams of gallic acid equivalents (GAE) per gram of dry sample (mg).

Table 1 Comprehensive list of herbs used in Battissa

Scientific name	Phytochemical Constituent	Post partum uses
Majufal *(Quercus infectoria)*	Gallic acid (Alam et al., 2002).	Helps firm the sagging breast and vaginal looseness and improve lubrication (Lorzadeh et al., 2016).
Ashwagandha *(Withania somnifera)*	Withanolides (Kulkarni et al., 2008).	Works for postpartum anxiety and depression (Pratte et al., 2014).
Sua *(Anethum graveolens)*	Carvone, phellandrene and limonene.	Used for pain and swelling during post-partum period.
Dalchini *(Cinnamomum verum)*	Cinnamic acid, hydroxyl cinnamaldehyde, cinnamyl alcohol, coumarin, cinnamyl acetate, borneol.	Blood sugar control during pregnancy.
Kaifal *(Myrica esculenta)*	Glycosides, diarylheptanoids, ionones, steroids, saponins, triterpenoids (Sood and Shri, 2018).	Uterine contraction during parturition.
Chhoti Pippal *(Piper longum)*	Piperine.	Induce expulsion of the placenta.
Nagkesar *(Mesua ferrea)*	Phenylcoumarins, xanthones and triterpenoids (Raju et al., 1976).	Loss of appetite and inflammation of uterus.
Ajwain *(Trachyspermum ammi)*	Thymene and carvacrol.	Improve milk production in breastfeeding mothers.
Chhoti Harar *(Terminalia chebula)*	Gallic acid, ellagic acid, chebulic acid and gallotannins.	Regulates metabolism, reduces risk of angina (Sadeghnia et al., 2017)
Lodhr *(Symplocos racemose)*	Flavonoids, phenols, tannins, saponins and glycosides (Choudhary et al., 2004)	Hormonal problems, endometriosis.
Nirgundi *(Vitex negundo)*	Glycosidic irridoids, flavonoids, terpenes, alkaloids, and steroids (Tandon et al., 2005; Vishwanathan et al., 2010).	Help to mitigate joint pain and muscle spasms which is very common after delivery.
Chopchini *(Smilax china)*	Taxifolin-3-O-glycoside, Piceid, Oxyresveratrol; Engeletin; Resveratrol, Scirpusin (Shao et al. 2007).	Uterine tonic for rejuvenate the fertility (Jeong et al., 2013).

Sonth *(Zingiber officinale)*	Gingerols, Shogaols, and Paradols	Help stimulate the production of breast milk for breastfeeding mothers.
Mochras *(Bombax ceiba)*	Bombamalosides, Shamimicin, Bombasin, and Bombalin.	Cure vaginal discharge.
Manjistha *(Rubia cordifolia)*	Anthraquinones, Naphthoquinones, Glycosides, Terpenes, Bicyclic Hexapeptides, carboxylic acids.	Clear the uterine channels.
Methi *(Trigonella foenum-graecum)*	Trigonelline and Choline.	Stimulate breast milk production.
Kali Musli *(Curculigo orchioides)*	Curculignin and Curculigol.	Helps in liver detoxification and nourishment.
Safed Musli *(Chlorophytum borivilianum)*	Sapogenin (Mishra, 1994).	Useful as a nutritive tonic for both the mother and the foetus.
Bala *(Sida cordifolia)*	Alkaloids, choline and betaine (Khatoon et al., 2005).	Treatment of vaginitis disorder.
Makhana *(Euryale ferox)*	Kaempferol.	Regulate the bowel movements post-delivery and helps in production of milk.
Lajwanti *(Mimosa pudica)*	Mimosine (Ahmad et al., 2012).	Effective against urinary tract infection (UTI) (Pawaskar et al., 2006).
Meda Lakdi *(Litsea Glutinosa)*	alkaloids, anthraquinones, falvonoids, phenols, saponins, steroids, tannins and terpenoids.	Relieving pain and arousing sexual power.
Gengchi *(Grewia populifolia)*	Diterpines, glycosides, alkaloids, triterpenoids, sterols flavonoids, saponins, tannins (Patil et al., 2011).	Milk production (Aschers et al., 2004).
Kamarkas *(Butea monospermum)*	Butin, isobutrin and butein.	Helps in reshaping the body post-delivery (Jain et al., 2010).
Munakka *(Vitis vinifera)*	Kaempferol.	Provides strengthening to the weakened bone.
Satavari *(Asparagus racemosus)*	Quercitin, rutin and hyperoside (Paliwal et al., 1991).	Increase milk production.
Chikni Supari *(Areca catechu L.)*	Arecoline	Overcome calcium deficiency.
Gond *(Astragalus gummifer)*	Isoflavones	Provides energy at the time of labor, helps develop strong bones and prevent back pain.
Badi Elaichi *(Amomum subulatum)*	Cardamonin, alpinetin, glycosides (Gopal et al., 2012).	Anti-inflammatory and digestive property (Jafri et al., 2001).

ISSN (Online) 2456 -1304

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Chhoti Elaichi *(Elettaria cardamomum)*	1,8-cineole and α-terpinyl acetate (Lawrence et al., 1979).	Anti-anxiety effect.
Clove *(Syzygium aromaticum)*	Phenolic acids and gallic acid (Shan et al., 2005).	Promote bone development of the baby.
Coconut *(Cocos nucifera)*	Flavonoids, tannins.	Assist in Digestion, lactation and brain clarity.

The concentration of plant extract enabled the determination of total phenolics content. The Gallic acid calibration curve demonstrated increasing absorbance with rising Gallic acid concentration. UV-VIS spectroscopy at 765nm revealed an absorbance of 1.843, corresponding to 44.022mg GAE/g dry extract in herbal methanolic Battissa extract. This suggests Battissa extract boasts substantial antioxidant capacity owing to its elevated total phenolic content, likely attributed to synergistic phenolic metabolites from diverse herbs and their products within Battissa powder.

Total Flavonoid Content

Flavonoids, as secondary metabolites, exhibit antioxidative properties, with their content serving as a vital parameter for evaluating food and medicinal plant samples. The antioxidant potency is contingent on the quantity and positioning of free OH groups within the compound (Panche et al., 2016). Additionally, their structural attributes align optimally with free radical scavenging, further enhancing their biological activity (Amarowicz et al., 2004).

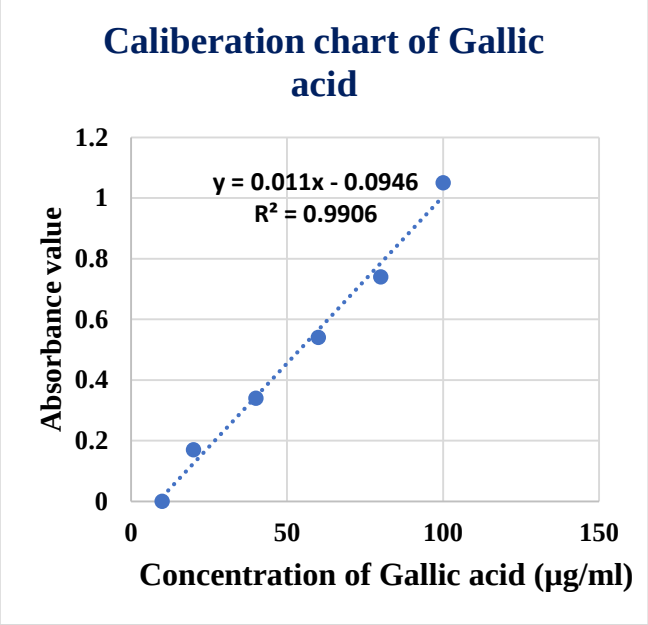

Figure 1 Calibration curve of Gallic acid

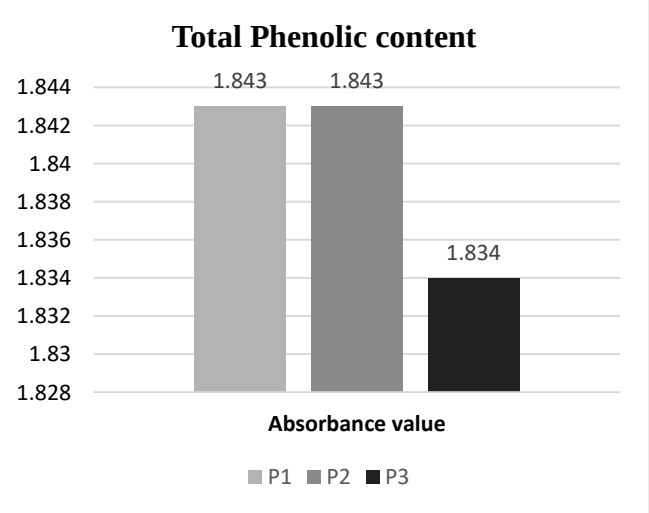

Figure 2 Total Phenolic Content

The quantitative assessment of flavonoid content in Battissa extracts involved constructing a calibration curve using absorbance values at various quercetin concentrations. Total flavonoid content in the extracts was determined using the calibration curve equation (y = 0.002x - 0.0122, R2 = 0.99) within the quercetin concentration range of 0–100 µg/mL and expressed as quercetin equivalents (QE) per gram of dry extract weight.

Total flavonoids were expressed as milligram Quercetin equivalents (QE) per gram dry weight of extract through the calibration curve with Quercetin.

The total flavonoid was calculated by using the formula.

$TFC = C \times V/m$

Where, TFC =Total flavonoids content in mg/g;

C = concentration of Quercetin established from the calibration curve in mg/ml.

V = volume of extract in ml; m = weight of plant extract in g; QE = Quercetin.

ISSN (Online) 2456 -1304

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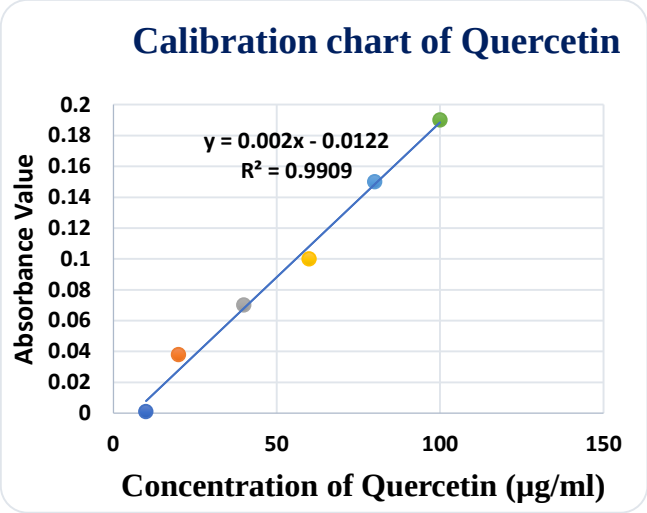

Figure 3 Calibration curve of Quercetin

The concentration of plant extract allowed for the determination of total flavonoid content. The calibration curve for Quercetin demonstrated a linear relationship between absorbance and Quercetin concentration. UV-VIS spectroscopy of Battissa herbal aqueous extract at 510nm revealed an absorbance of 0.223, equivalent to 235.2mg QE/g dry extract.

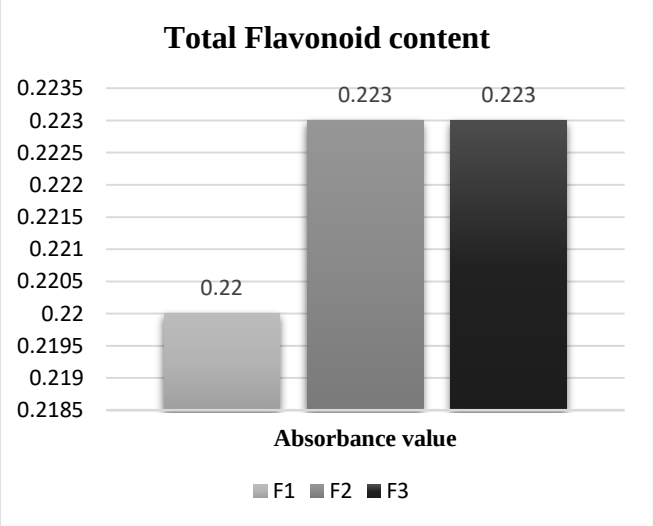

Figure 4 Total Flavonoid Content

The findings demonstrate that Battissa plant extract is a potent source of total phenolic and flavonoid content. Analytical results underscore the distinct composition of phenolic compounds within each Battissa sample, separate from the flavonoid category. This study offers a comprehensive framework for postpartum complications and associated dietary interventions. Battissa comprises 32 herbs containing diverse phytoconstituents such as piperine, myricetin, shatavarin, boldine, chebulin, gallic acid, butin, triterpenoids, and more, exhibiting synergistic and bioenhancing properties. Consequently, the utilization of Battissa as a composite remedy is often recommended.

V. CONCLUSION

In summary, our study underscores the significance of plant-based remedies in traditional medicinal systems, including Ayurveda, Siddha, Unani, and Tibetan, as potential treatments for various ailments. The utilization of 32 herbs in Battissa holds substantial ethnobotanical importance, particularly during pregnancy, where they are considered safe for regular consumption. Existing literature supports their long-term benefits for postpartum women's health care.

The study highlighted the role of phytochemical constituents in postpartum recovery, with the Battissa formulation exhibiting synergistic antioxidant, bioenhancing, and immunomodulatory effects. The synergy among plant components enhances bioactivity, mainly due to the presence of secondary metabolites with multitarget modulating properties. Overall, our investigation supports the traditional use of these herbs in postpartum care, emphasizing their natural antioxidant significance.

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