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Proximate composition, phytochemical screening and identification of bioactive compounds in Cowpea [*Vigna unguiculata* (L.) Walp.] var. PKM 1 seed using gas chromatography mass spectrometry (GC-MS)

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Abstract

This study explored the proximate composition, phytochemical screening and identification of bioactive compounds in Cowpea [*Vigna unguiculata* (L.) Walp.] var. PKM 1 seed using gas chromatography mass spectrometry, conducted during 2023-2024 at the Western Farm of HC&RI, Periyakulam, Tamil Nadu. The proximate analysis revealed the $13.24 \pm 0.60\%$ of moisture, 68.45 ± 0.34 g/100 g of carbohydrates, 21.34 ± 0.37 g/100 g of protein, 2.13 ± 0.64 g/100 g of fat, 2.34 ± 0.97 g/100 g of crude fiber and 4.17 ± 0.17 g/100 g of ash. Phytochemical screening of petroleum ether, ethanol, methanol, chloroform, and aqueous extracts of cowpea seeds identified the presence of key primary and secondary metabolites, such as alkaloids, terpenoids, cardiac glycosides, flavonoids, phenols, and saponins. These phytochemical constituents adhered to standard ranges and provide a foundation for identifying crude drugs and isolating bioactive compounds with medicinal significance. The GC-MS analysis identified 13 different compounds with varying concentrations. The obtained results, it is evident that cowpea seeds composed of huge amount of oleic acid and 9-octadecenoic acid (Z)-, methyl ester and other phytochemicals in moderate amount. These findings underscore the nutritional value and bioactive potential of cowpea, highlighting its significance in both medicinal and functional applications.

1. Introduction

Vigna unguiculata (L.) Walp., commonly referred to as cowpea, is a leguminous crop from the Fabaceae family. Domesticated in Africa centuries ago, it is now cultivated globally, particularly in tropical and semi-arid regions. Historically, cowpea was one of the most widely consumed beans in the worldwide and continues to play a vital role in providing dietary protein, particularly in India, East Asia and Africa. Known as black-eyed pea or southern pea, it is a popular vegetable garden plant in many regions. Cowpea holds significant economic and ecological value. It improves soil fertility by fixing nitrogen and is used as fodder for livestock (Barik *et al.*, 2023). The plant produces dry, dehiscent pods containing seeds that are highly nutritious, consisting of approximately 24% crude protein, 53% carbohydrates and 2% fat. Additionally, its leaves and flowers are edible. The seeds are a rich source of plant-based proteins and vitamins B like riboflavin and niacin, essential for energy metabolism.

Regular consumption of cowpea provides numerous health benefits, including enhanced immune function by supporting spleen health and cellular regeneration. Traditionally, cowpea seeds have been used to address common health issues such as colds, intestinal worms, and hematuria (blood in urine). Its roots are used in traditional remedies for snake bites, epilepsy, pain relief, menstrual discomfort, and chest pain. The leaves are applied to burns or used as a snuff for headaches. Cowpea seeds are also valued for their diuretic and anthelmintic properties and are used to treat liver conditions, including jaundice. In India, cowpeas are commonly consumed as whole cooked seeds or immature seeds, often prepared by boiling, frying, roasting, or spicing, with cooking water considered a remedy for colds (Sudharani *et al.*, 2020).

Legumes, including cowpeas, are among the most important food sources after cereals. They play a crucial role in agriculture and environmental sustainability by forming symbiotic relationships with nitrogen-fixing bacteria and arbuscular mycorrhizal fungi, reducing the need for synthetic fertilizers and lowering greenhouse gas emissions such as N₂O. Commonly consumed legumes include soybeans, chickpeas, lentils, green peas, and peanuts (Giridhar *et al.*, 2020). These crops are rich in protein, dietary fiber, starch, vitamins, minerals, and phytochemicals, offering protective effects against non-communicable diseases. Recent studies have highlighted the bioactive potential of cowpeas, revealing their *in vitro* anticancer

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activity against human colorectal adenocarcinoma (HT-29) and human breast adenocarcinoma (MCF-7) cells. The phenolic compounds responsible for these effects vary across legumes, often influenced by seed coat color. This research emphasizes the phytochemical composition, total phenol and flavonoid content, and antioxidant properties of cowpea, displaying its potential as a functional food with notable health benefits (Dubale *et al.*, 2023).

2. Materials and Methods

2.1 Material and authentication of plant

Dr. R. Ramasubbu, Associate Professor, Department of Biology, Gandhigram Rural Institute, Gandhigram, Dindigul, conducted the entire botanical authentication and identification of the Plant Specimen. The Plant Specimen is catalogued under Collection 389 and stored at the GUD Herbarium. Cowpea seeds were collected from the western farm of the Department of Vegetable Sciences, Horticulture College and Research Institute, Periyakulam. It is located at 11.1283°N and 76.5998°E at an altitude of 416 metres. The harvested seeds were thoroughly washed to remove stones, chaff and plant debris, rinsed in distilled water and dried in sunlight. The dried seeds were crushed in a hammer mill and passed through a 0.2 mm sieve. The resulting fine powder was stored in labelled airtight containers for subsequent analysis.

2.2 Proximate composition

Moisture, carbohydrate, protein, fat, crude fiber, and ash were analyzed according to the Association of Official Analytical Chemists (AOAC) protocols. Moisture and ash were measured using the AOAC (1995) method, and crude fiber was measured using the Maynard method (1970). Nitrogen content was measured using the micro-kjeldahl method (AOAC, 1990), and crude protein was calculated by multiplying the nitrogen percentage by 6.25. Total carbohydrate content was estimated by using the following formula:

$$\text{Total carbohydrate content (\%)} = [100 - (\text{Moisture (\%)} + \text{Ash (\%)} + \text{Crude fat (\%)} + \text{Crude fiber (\%)} + \text{Crude protein (\%)}].$$

2.3 Preparation of extracts

Cowpea seeds were gathered and thoroughly rinsed with tap water, then dried in the shade in open air. The dried seeds were mechanically pulverized into a fine powder. About 100 g of the seed powder was separately immersed in 100 ml of different solvents, including methanol, chloroform, ethanol, petroleum ether, and water, in conical flasks. The mixtures were then filtered with whatman No. 42 filter paper. The concentrated extracts were kept in sterilized, air-tight, labeled containers and refrigerated at 4°C until needed. The extracts underwent filtration under reduced pressure using a rotary flash evaporator and were subsequently analyzed for preliminary phytochemical composition.

2.4 Test for identification

A series of phytochemical tests were performed to identify the presence of various phytochemical compounds in cowpea seeds (Souhoka *et al.*, 2021).

2.4.1 Test of flavonoids

1.5 ml of a 50% methanol solution was added to 4 ml of the extract and then gently warmed. Next, a small quantity of magnesium metal was added, preceded by the introduction of 5-6 drops of concentrated

hydrochloric acid. The presence of red colour indicated the presence of flavonoids.

2.4.2 Test for alkaloids

5 ml of the extract were mixed with 5 ml of a 2% ammonium chloride (NH₄Cl) solution and then boiled. Following boiling, the mixture was filtered, and a few drops of Mayer's reagent were then introduced to the filtered liquid. The rapid formation of a cream-colored precipitate signified the presence of alkaloids.

2.4.3 Test of steroids

1 ml of the extract was dissolved in 10 ml of chloroform, and an equal volume of concentrated sulphuric acid was added cautiously down the sides of the test tube. The presence of steroids was indicated by a red color in the upper layer and a yellow colour with green fluorescence.

2.4.4 Test for phenols

Ferric chloride solution was added in a 2 ml amount to a 2 ml quantity of the plant extract to test the phenols. The formation of a bluish-green coloured solution indicated the presence of phenols.

2.4.5 Test of saponins

5 ml of extract was mixed with 10 ml of distilled water in a test tube and then shaken vigorously for 30 seconds after boiling. The test tube was then left to remain stationary for thirty minutes. The formation of froth signified the existence of saponins.

2.4.6 Test for cardioglycosides

A solution of the extract was made by adding glacial acetic acid along with a few drops of 5% ferric chloride and concentrated sulfuric acid. Observations revealed a reddish-brown color at the interface between the two layers and a bluish-green hue in the upper layer.

2.4.7 Test for terpenoids

A quantity of 0.8 g of the chosen plant sample was placed in a test tube, and 10 ml of methanol were added. The mixture was thoroughly agitated and then filtered to yield 5 ml of the plant extract. Next, 2 ml of chloroform was combined with the extract, and then 3 ml of sulfuric acid was added. The formation of a reddish-brown color signalled the presence of terpenoids in the chosen plant sample.

2.5 Gas-chromatography mass-spectrometry (GC-MS) analysis

After measuring and placing the required quantity of cowpea seed powder into a sealed flask, methanol was added to start the extraction process. The mixture was allowed to infuse for 24 h, then filtered and dried using a vacuum distillation apparatus. The resulting residue was subsequently analysed using a GC-MS system. The analysis was conducted with a Thermo GC Ultra Clarus 550 system, which combines a gas chromatograph with a mass spectrometer (GC-MS) equipped with an Elite-I fused RMS 6 silica capillary column made of dimethyl polysiloxane. Detection was performed with an electron ionization device set to an ionizing energy of 60 eV. A 1 µl sample was injected with a split ratio of 12:1, and helium (99.9%) served as the carrier gas at a constant flow rate of 2 ml/min. The ion source and injector temperatures were set to 230°C and 240°C, respectively. The oven temperature was programmed to start at 90°C, increase by 5°C per min until it reached 240°C, and then remain isothermal for three minutes. Mass spectra were recorded for fragments ranging

from 50 to 650 Da, with a scan interval of 0.5 sec. Turbo Mass software was used to analyze the mass spectra and chromatograms, and the percentage composition of each component was calculated by comparing the average peak area of each to the total peak area (Dutta *et al.*, 2020).

2.6 Identification of bioactive components

The mass spectra from the GC-MS were analyzed and interpreted using the National Institute of Standards and Technology (NIST) database, which includes retention values for over 95,000 compounds. Spectra from both the NIST and Wiley libraries were used to match unknown components with known substances. This approach enabled the identification, molecular weight, and compositional analysis of the test materials.

2.7 Biological activity of identified substances

To generated predictions regarding the biological impacts of the compounds using PASS (prediction of activity spectra for biologically active substances), based on their structural formulas. According to the PASS online database (Filimonov *et al.*, 2014; Kamaljeet *et al.*, 2024). This process involved forecasting a range of pharmacological effects, potential toxicities, and possible modes of action associated with the compounds.

3. Results

3.1 Proximate composition

As shown in Table 1, cowpea contains $13.24 \pm 0.60\%$ of moisture, 68.45 ± 0.34 g/100 g of carbohydrates, 21.34 ± 0.37 g/100 g of protein, 2.13 ± 0.64 g/100 g of fat, 2.34 ± 0.97 g/100 g of crude fiber and 4.17 ± 0.17 g/100 g of ash.

Table 2: Phytochemical screening of various extracts of cowpea

S. No.	Secondary metabolite	Methanol extract	Chloroform extract	Ethanol extract	Petroleum ether extract	Aqueous extract
1.	Flavonoids	+++	++	+	+	+
2.	Alkaloids	+++	+++	++	+	++
3.	Steroids	+++	+++	-	++	+
4.	Phenols	+	-	+	-	-
5.	Saponins	+++	++	-	+	+
6.	Cardiac glycoside	+++	+++	+	++	++
7.	Terpenoids	+++	+++	++	++	+

*Note: + (Present in low quantity), ++ (Present in moderate quantity), +++ (Present in high quantity) and - (Absent)

3.3 Bioactive compounds profiling using GC-MS analysis

GC-MS analysis was conducted to identify the compounds in Cowpea seeds. The chromatogram and mass spectrum (Figure 1) indicates that the cowpea seeds contain various components. The identified compounds, along with their peak area (%), and molecular formula were presented in Table 3. The analysis identified 13 different compounds with varying concentrations. Compound 1, α -D-glucopyranose, 4-O- α -D-galactopyranosyl- ($C_{12}H_{22}O_{11}$), exhibited a peak ratio of 5.30%. Compound 2, hexadecanoic acid ethyl ester ($C_{18}H_{36}O_2$), had a peak ratio of 2.62%, while compound 3, n-hexadecanoic acid ($C_{15}H_{32}O_2$), showed a peak ratio of 7.02%. Compound 4, 9-octadecenoic acid (Z)-methyl ester ($C_{19}H_{36}O_2$),

Table 1: Proximate composition of cowpea

S. No.	Constituents	Composition
1.	Moisture (%)	13.24 ± 0.60
2.	Carbohydrate (g/100 g)	68.45 ± 0.34
3.	Protein (g/100 g)	21.34 ± 0.37
4.	Fat (g/100 g)	2.13 ± 0.64
5.	Crude fiber (g/100 g)	2.34 ± 0.97
6.	Ash (g/100 g)	4.17 ± 0.17

3.2 Phytochemicals screening

The phytochemical screening of cowpea seeds used in this study are presented in Table 2. The findings suggest that quantitative chemical analysis was effective for the preliminary phytochemical characterization of the species and could potentially aid in predicting the presence of bioactive compounds. From the Table 2, alkaloids, terpenoids, cardiacglycoside and flavonoids were maximum present in the cowpea seeds. Phenols and saponin were low presence in less quantity. Flavonoids are present in more quantity in methanol and chloroform extract of cowpea seeds. Alkaloids are present in more quantity in methanol and chloroform extract but absent in ethanol extract. The phenols were only detected in the methanol and ethanol extracts were compared to chloroform extract. The saponin are present in more quantity in methanol extract and absent in ethanol extract. The cardiac glycoside and terpenoids are present in more quantity in methanol and chloroform extract. The methanol and chloroform extracts of studied in cowpea seeds showed the presence large quantity of bioactive compounds.

displayed a peak ratio of 0.89%. Compound 5, 9,12-octadecadienoic acid (Z, Z) - ($C_{18}H_{32}O_2$), had a peak ratio of 8.45%. Compound 6, oleic acid ($C_{18}H_{34}O_2$), was the most abundant, with a peak ratio of 57.92%. Compound 7, 10-methyl-E-11-tridecen-1-ol-propionate ($C_{17}H_{32}O_2$), showed a peak ratio of 2.64%. Compound 8, 3',8,8'-trimethoxy-3-piperidyl-2,2'-binaphthalene-1,1',4,4'-tetrone ($C_{28}H_{25}O_7$), had a peak ratio of 4.12%. Compound 9, 2-myristoyl pantetheine ($C_{25}H_{44}N_2O_5S$), displayed a peak area percentage of 0.99%. Compound 10, 9-octadecenoic acid (Z)-, 2-hydroxy-1-(hydroxymethyl) ethyl ester ($C_{21}H_{40}O_4$), showed a peak area of 1.98%. Compound 11, 9,10-secocholesta-5,7,10(19)-triene-3,24,25-triol, (3a, 5Z, 7E)- ($C_{27}H_{44}O_3$), had a peak ratio of 3.22%. Compound

12, ethyl iso-allocholate ($C_{26}H_{44}O_5$), displayed a peak area of 2.92%. Lastly, compound 13, digitoxin ($C_{41}H_{64}O_{13}$), had a peak area of 1.93%. The results indicate that oleic acid is the predominant

compound, with the others being present in moderate amounts. The retention time ranged from 8.21 to 33.82, and the molecular weights of the identified compounds varied between 256 and 764.

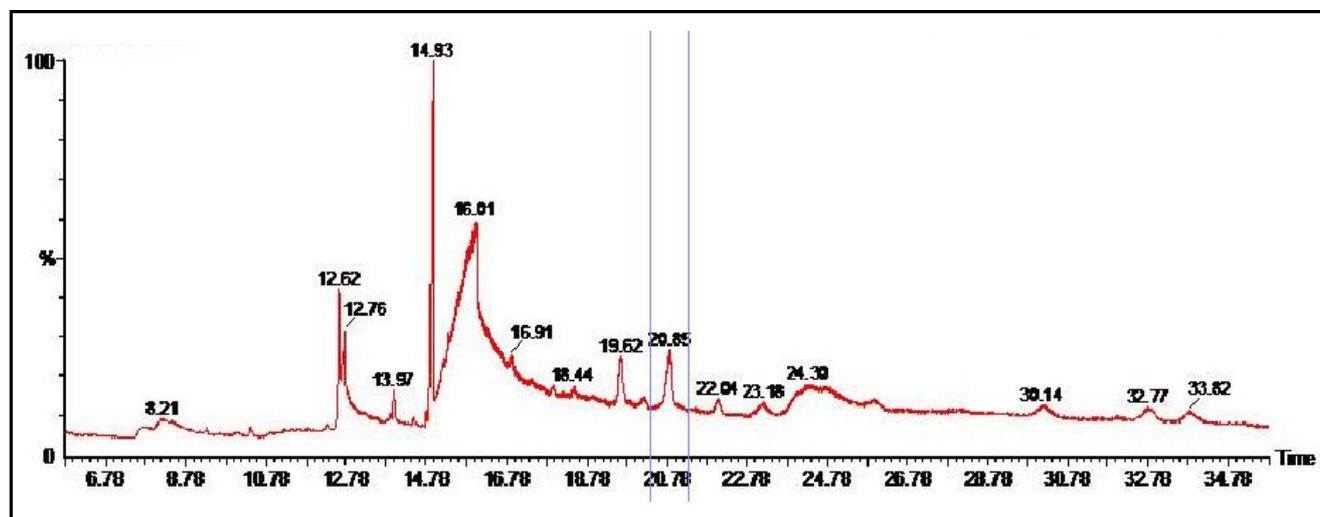


Figure 1: Chromatogram of methanol extract of cowpea seeds.

Table 3: Different bioactive compound present in the seeds of cowpea with their compound name, peak area, retention time molecular formula and molecular weight

S. No.	Compound name	Peak area (%)	Retention time	Molecular formula	Molecular weight
1.	9-octadecenoic acid (Z)-, methyl ester	0.89	13.97	$C_{19}H_{36}O_2$	296
2.	2-myristinoyl pantotheine	0.99	22.04	$C_{22}H_{44}N_2O_{5S}$	484
3.	Digitoxin	1.93	33.82	$C_{41}H_{64}O_{13}$	764
4.	9-octadecenoic acid (Z)-, 2-hydroxy-1-(hydroxymethyl) ethyl ester	1.98	24.30	$C_{21}H_{40}O_4$	356
5.	Hexadecanoic acid, ethyl ester	2.62	12.62	$C_{18}H_{36}O_2$	284
6.	10-methyl-E-11-tridecen-1-ol propionate	2.64	19.62	$C_{17}H_{32}O_2$	268
7.	Ethyl iso-allocholate	2.92	32.77	$C_{26}H_{44}N_5$	436
8.	9,10-secocholesta-5,7,10(19)-triene-3,24,25-triol, (3 α ,5Z,7E)	3.22	30.14	$C_{27}H_{44}O_3$	416
9.	3',8,8'-trimethoxy-3-piperidyl-2,2'-binaphthalene-1,1',4,4'-tetrone	4.12	20.85	$C_{28}H_{25}NO_7$	487
10.	α -D-glucopyranose, 4-O- α -D-galactopyranosyl	5.30	8.21	$C_{12}H_{22}O_{11}$	342
11.	n-hexadecanoic acid	7.02	12.76	$C_{16}H_{32}O_2$	256
12.	9,12-octadecadienoic acid	8.45	14.93	$C_{18}H_{32}O_2$	280
13.	Oleic Acid	57.96	16.01	$C_{18}H_{34}O_2$	282

4. Discussion

This study highlights the health-promoting benefits of cowpeas, demonstrating its potential as a functional food. In terms of proximate composition, cowpeas exhibited higher moisture and carbohydrate content, while the protein content was lower compared to other studies. Cowpea is widely recognized as a significant source of organic antioxidants globally. Plants contain phytochemicals with unique physiological effects on humans, which can be utilized for medicinal purposes (Karuwal *et al.*, 2023). The study's findings indicate that

the moisture content of cowpea seeds is within the predicted range. Seeds with high moisture contents are highly perishable and prone to microbial deterioration when stored. Because of its comparatively low moisture content, cowpea seeds have a longer shelf life and inhibits the growth of microorganisms (Shunmugadevi *et al.*, 2020). The ash value indicates that cowpea is a good source of inorganic minerals. A high mineral deposit is indicated by a high ash content in food (Oliveira *et al.*, 2023). Comparing the fat content of this study to that of other plants, it is moderate. Through the absorption and retention of flavors, dietary fats contribute to the increased

palatability of food (Akissoe *et al.*, 2021). Humans are considered to require a diet that contains no more than 2% of their energy in the form of fat, as consuming too much fat has been linked to various cardiovascular conditions like atherosclerosis, cancer and aging (Rivier *et al.*, 2021). Although, crude fiber is low in nutrients, eating enough of it can help reduce blood cholesterol, help the body absorb trace minerals, aid in the absorption of nutrients in the gut, and lower the risk of heart disease, diabetes, colon and breast cancer, as well as constipation and hypertension (Biama *et al.*, 2020). According to diet, the study's findings on the fiber content of cowpea are consistent with earlier research and adequate. According to the protein value of our sample, cowpea contains high-quality proteins that are suitable for human and animal diets and can effectively meet daily protein requirements (Enyiukwn *et al.*, 2020; Amaefula *et al.*, 2024). The natural synthesis and maintenance of bodily tissues, hormones, enzymes, and other chemicals necessary for proper operation depend on dietary proteins. (Santos *et al.*, 2022; Alghamdi *et al.*, 2023). Cowpea has a high carbohydrate content compared to other crops, which implies that it could be a useful supplement in addition to a source of energy and organic materials for building. Typically making up the majority of a diet, carbohydrates are essential because they give blood, muscles, and brain cells energy. In addition to serving as a mild laxative for people, they aid in the metabolism of fat and spare proteins for energy (Seke *et al.*, 2023).

The alkaloids, terpenoids, cardioglycoside and flavonoids were maximum present in the cowpea seeds. Phenols and saponin were low present in less quantity. Flavonoids, alkaloids are present in more quantity in methanol and chloroform extract of cowpea. Flavonoids are water soluble polyphenolic compounds with a variety of uses, including cytotoxic antitumor activity, estrogenic activity, enzyme inhibition, antimicrobial, antiallergic, antioxidant, and antiulcerogenic properties. The duodenal tract contains flavonoids that reduce the risk of heart disease. Furthermore, flavonoids prevent the development of ulcers by promoting the formation of a gastric mucosa cover, enhancing capillary resistance, and enhancing microcirculation, all of which lessen the cellular sensitivity to precipitating factors. Due to their widespread use in ethnomedical practices for analgesic, antispasmodic and antimicrobial treatments, alkaloids are important for protection against microbiological and pesticide activities. The pharmacological properties of alkaloids include antibacterial, antifungal, anticancer, antihypertensive and antimalarial properties that can be used to treat various ailments (Subroto *et al.*, 2021).

The steroids are present in more quantity in methanol, petroleum ether extract and chloroform extract but absent in ethanol extract. Besides their cardiogenic effects, plant steroids are recognized for their antibacterial and insecticidal properties. They are also used in diets, herbal remedies, and cosmetics. Their extensive biological activities make them valuable in medical applications (Juman *et al.*, 2024). The phenols were only detected in the methanol and ethanol extracts were compared to chloroform extract. Phenols have important medicinal applications because of their astringent qualities. They encourage the creation of new tissues on wounds and inflammatory mucosa, as well as quick healing. Phenols are used to treat minor burns, varicose ulcers, hemorrhoids, frostbite, and gum inflammation. Internal administration of phenols is used as an antidote for intestinal catarrh, diarrhea, and heavy metal poisoning. These substances have shown promise in the treatment of viral diseases,

such as AIDS, in recent years (Thanga *et al.*, 2024). The saponin are present in more quantity in methanol extract and absent in ethanol extract. According to Manasa *et al.* (2023), saponins are used to treat fungal and yeast infections, have hemolytic properties, bind cholesterol and have an antimicrobial effect against mold. Additionally, saponins stop cancer cells from multiplying, preventing the body from producing unwanted cancer cells. The saponin content of the sample, which helps fight infection and microbial invasion, could be the reason for it being used as a natural antibiotic.

The cardioglycoside and terpenoids are present in more quantity in methanol and chloroform extract. The known mechanism of action of cardiac glycosides is inhibition of the Na^+ / K^+ pump. This increases the concentration of sodium ions in the myocytes, which in turn increases the concentration of calcium ions. They are used to treat cardiac arrhythmias and heart failure because this inhibition increases the amount of Ca^{2+} ions available for contraction of the heart muscle, which increases cardiac output and reduces cardiac stretch. They are also used to strengthen and improve the function of a failing heart; however, the dosage needs to be carefully monitored as the therapeutic dose is close to the toxic dose (Sujatha *et al.*, 2022). The presence of terpenoids in cowpea indicates its antifungal and antibacterial activity, which is due to the destruction of the membrane and the inhibitory effect on bacterial cells or fungi (Adekanmi *et al.*, 2020).

α -D-glucopyranose, 4-O- α -D-galactopyranosyl ($\text{C}_{12}\text{H}_{22}\text{O}_{11}$) is exhibits anti-TB activity and has shown promising antibacterial effects against Gram-positive bacterial strains. The hexadecanoic acid ethyl ester ($\text{C}_{18}\text{H}_{36}\text{O}_2$) is possesses anti-proliferative activity and is utilized as an anti-emetic in cancer chemotherapy, n-hexadecanoic acid ($\text{C}_{16}\text{H}_{32}\text{O}_2$) is a biochemical reagent that can be utilized as a biological material or organic compound with strong anticancer activity, 9-Octadecenoic acid (Z)-methyl ester ($\text{C}_{19}\text{H}_{36}\text{O}_2$) is the most commonly used insecticide because of its low toxicity to mammals and its short environmental half-life, 9,12-octadecadienoic acid (Z, Z)- ($\text{C}_{18}\text{H}_{32}\text{O}_2$) is used in the production of certain pesticides or as an additive in some pesticide formulations, oleic acid ($\text{C}_{18}\text{H}_{34}\text{O}_2$) is used to treat acute hyperammonemia, which is associated with depression and other mental health disorders, 10-methyl-E-11-tridecen-1-ol-propionate ($\text{C}_{17}\text{H}_{32}\text{O}_2$) is a potent toxin used to selectively target and destroy dopaminergic neurons in the substantia nigra, thereby inducing parkinsonism, 3',8,8'-trimethoxy-3-piperidyl-2,2'-binaphthalene-1,1',4,4'-tetrone ($\text{C}_{28}\text{H}_{25}\text{O}_7$) is have a anti-leukemic activity, it may also help prevent mood disorders when taken as a supplement, 2-myristynoyl pantetheine ($\text{C}_{25}\text{H}_{44}\text{N}_2\text{O}_5\text{S}$) is a novel therapeutic for fungal infections, used as an antifungal agent to treat conditions such as ringworm and athlete's foot, 9-octadecenoic acid (Z)-,2-hydroxy-1-(hydroxymethyl) ethyl ester ($\text{C}_{21}\text{H}_{40}\text{O}_4$) it has been studied for its pharmacological effects, especially its ability to inhibit the uptake of neuronal 5-hydroxytryptamine (5-HT), 9,10-secocholesta-5,7,10(19)-triene-3,24,25-triol, (3a,5Z,7E) ($\text{C}_{27}\text{H}_{44}\text{O}_3$) an antimicrobial agent that inhibits bacteria, yeasts, and molds, and is used both as a reducing agent and a disinfectant, ethyl iso-allocholate ($\text{C}_{26}\text{H}_{44}\text{O}_5$) has very potent anti-inflammatory, analgesic, and antipyretic effects, digitoxin ($\text{C}_{41}\text{H}_{64}\text{O}_{13}$) is used in treatment of ischemic cerebrovascular disease, this drug also addresses antirheumatic and rheumatoid conditions, as well as helps prevent tumors (Shnumugapriya *et al.*, 2017; Aggarwal *et al.*, 2022; Islam *et al.*, 2020)

5. Conclusion

The results demonstrate the presence of phytochemical constituents and antioxidant properties, which are valuable for the development of new drugs. The phytochemical analysis conducted previously and in the present study show similar outcomes, reflecting the presence of these bioactive compounds. Numerous studies have confirmed the presence of these phytochemicals, which contribute both medicinal and physiological benefits to the plant, aiding in the treatment of various ailments. According to our obtained results, it is evident that dry cowpea seeds composed of huge amount of oleic acid and 9-octadecenoic acid (Z)-, methyl ester and other phytochemicals in moderate amount. As a result, pharmaceutical researchers and industries are increasingly turning to cowpea as a vital raw material for drug development and production.

Conflict of interest

The author declares no conflicts of interest relevant to this article.

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