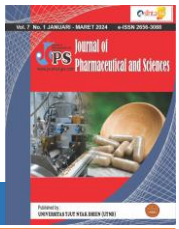
Journal of Pharmaceutical and Sciences
Electronic ISSN: 2656-3088 DOI: https://doi.org/10.36490/journal-jps.com
Homepage: https://journal-jps.com
ORIGINAL ARTICLE JPS. 2024, 7(1), 100-114



In vitro and in silico evaluation of toxicological and anti-proliferative activity in phytochemical compounds of several solvent extracts from *Zaleya pentandra* L

Evaluasi in vitro dan in silico aktivitas toksikologi dan anti proliferasi senyawa fitokimia beberapa ekstrak pelarut dari *Zaleya Pentandra* L

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Abstract

Therapeutic Medicinal plants and herbals are vital superior nutrient resources mainly used in diet and recognised for treating various diseases. The study's main objective is to investigate phytochemicals compounds, antioxidant and antibacterial activities on five *Zaleya pentandra* extract (ZPE), ethanol, hexane, acetone, ethyl acetate, and methanol for the first time. Methods: The study was conducted using the HPLC-MS, and measurements were made in three replicates. Results: The most significant extracts, revealing 13compounds, which appear higher content (417.5±0.44 µg/g and (407.5±0.04 µg/g), value of ZPE in total β-Sitosterol and dioctyl phthalate, respectively, also the total polyphenol content (TPC) was significantly (p≤0.05) higher mainly in acetone (323.06±1.74mg GAE/g), ethyl acetate (220 ± 1.00) mg GAE/g), and hexane herbal extracts (75.2±1.70) mg QE/g) with a significant difference (P≤0.05) in total flavonoid content. Discussion: All investigated bacterial strains had an exceptionally high effect against B. subtilis. A computational analysis qualified a significant drug-likeness feature, including toxicological and pharmacokinetic assessments. ZP acetone extract is an appropriate selection for creating contemporary antibacterial compounds. Conclusions: The current study offers new information on applying ZPE in novel and potentially effective therapeutic agents, its application in the food industry, and the treatment of different diseases.

***Keywords*: Medicinal Plants Extracts, phytochemical compounds, Pharmacokinetic.**

Abstrak

Tanaman obat dan herbal merupakan sumber nutrisi unggul yang penting, terutama digunakan dalam makanan dan untuk mengobati berbagai penyakit. **Tujuan:** Tujuan utama dari penelitian ini adalah untuk mengetahui senyawa fitokimia, aktivitas antioksidan dan antibakteri pada lima ekstrak *Zaleya pentandra* (ZPE), etanol, heksana, aseton, etil asetat, dan metanol, untuk pertama kalinya. Metode: dilakukan dengan menggunakan HPLC-MS, pengukuran dilakukan sebanyak tiga kali ulangan. **Hasil:** ekstrak paling signifikan, mengungkapkan 13 senyawa, yang tampak memiliki kandungan lebih tinggi (417,5±0,44 µg/g dan (407,5±0,04 µg/g), nilai ZPE pada total β-Sitosterol dan dioctylphthalate, serta kandungan total polifenol (TPC) secara signifikan (p≤0,05) lebih tinggi terutama pada aseton (323,06±1,74mg GAE/g), etil asetat (220 ± 1,00) mg GAE/g), dan ekstrak herbal heksana (75,2±1,70) mg QE/g) dengan perbedaan yang signifikan (P≤0,05) terhadap total kandungan flavonoid. **Diskusi**: semua strain bakteri yang diselidiki, dengan efek yang sangat tinggi terhadap B. subtilis. Senyawa yang signifikan memiliki potensi menjadi senyawa obat dikualifikasikan melalui analisis komputasi yang mencakup penilaian toksikologi dan farmakokinetik. Ekstrak aseton *Zaleya pentandra* merupakan farksi yang potensial sebagai senyawa antibakteri baru. **Kesimpulan:** penelitian ini menawarkan informasi baru mengenai penerapan ZPE dalam agen terapi baru dan berpotensi efektif, penerapannya dalam industri makanan dan pengobatan berbagai penyakit.

Kata Kunci: Ekstrak Tumbuhan obat, fitokonstituen, Farmakokinetik.

Article History:
Received: 23/01/2024,
Revised: 24/03/2024
Accepted: 31/03/2024,
Available Online: 31/03/2024
QR access this Article

https://doi.org/10.36490/journal-jps.com.v7i1.404

Introduction

The number of recently approved antimicrobial medications has significantly decreased in recent years, and the supply of potent antimicrobials is expected to run out soon [1]. Medicinal plants used for centuries symbolise the past and are still vital for cutting-edge, potent pharmaceuticals. Because of medicinal plants' wide range of health advantages and therapeutic potential, the scientific literature on their use has recently seen a boom in nutrition and pharmaceuticals [2]. Medical plants and aromatics (MPA) are abundant in pharmacodynamic bioactive substances with excellent anti-oxidant contents to support human health and lifestyle. These compounds function through electron suppliers to the human body to neutralise free radicals and stop the red oxidation reaction [3,4].

They may contain phenolic acids (hydrobenzoic acids and hydrocinnamic), lignin, tannins, and flavonoids (flavanols, flavones, and anthocyanin) [5]. Herbs and plant-derived metabolites have long been used for medical and pharmacological purposes, and all civilisations worldwide have demonstrated their therapeutic benefits [6]. Natural bioactive compounds from medicinal plants have shown their full therapeutic potential in treating chronic and developing disorders [7]. They remain a viable medicinal research and development source, and the pharmaceutical industry uses them to replace unwanted synthetic compounds. On the other hand, the human body's exposure to several reactive species, including ROS and RNS (free radicals), leads to oxidative stress and multiple pathological conditions. Plant extracts are an emerging, appealing source for new medications because they can potentially treat infectious and incurable diseases with little side effects [8,9,10]. Similarly, the use of pharmaceuticals has a variety of adverse effects, which highlights the use of unique natural substances, which is the safest and most effective way to treat such diseases. Consequently, new environmentally friendly techniques are needed to stop the spread of harmful strains and treat various diseases. As a result, several aromatic and medicinal plants showed promise as antioxidants and antimicrobials, protecting the human body from oxidative stressors and infections. The antibacterial properties of Cassia (*Cinnamomum cassia*), fructuscorni (*Cornus officinalis*), and Chinese chives (*Allium tuber ovum*) have been tested against common foodborne germs both individually and in combination [11].

Around the world, in arid and semi-dry regions, Sudan purslane Zaleya pentandra family Aizoaceae is a significant weed that is widely distributed worldwide. It originated in Africa [12]. Previously published research, *Z. pentandra* methanol extract contains bioactive substances present in the extract that have various pharmacological effects: antioxidant, anti-inflammatory, anti-bacterial, and anti-cancer [13,14].

All the knowledge and skills derived from theories, beliefs, and experiences make up traditional therapy. Medicinal plants are beneficial for maintaining health when preventing, diagnosing, or treating mental and physical diseases [12]. According to *Zaleya pentandra* is an astringent drug that may treat snakebites and malaria. It is beneficial for treating diarrhoea, stomach problems, respiratory tract infections, and coughs [16, 15]. But it is regarded as poison in India, where it can result in severe nephritis, paralysis, and diarrhoea [17]. The whole plant is used in Pakistan to treat various kinds of infections [18]. In Sudan, the use of dried powder of herbal Zaleya pentandra (L.) and millet beer is the cure for gonorrhoea. In addition, they help with fungal infections, hyperlipidemia, hyperpigmentation, and neurodegenerative illnesses. No scientific study on various solvent extracts of *Z. pentandra* has ever been conducted, as soon as currently available information. Thus, the goal of the survey is towards evaluate Toxicological and Anti Proliferative Activity in phytochemical

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compounds of several extracts, ethanol, hexane, acetone, ethyl acetate, and methanol, from *Zaleya pentandra L.* (ZPE) aerial parts (Figure 1), for the first time and investigate their antimicrobial and antioxidant properties.

Figure. 1. *Zaleya pentandra* plant of Sudan (White Nile)

Experimental Section

Plant Collection and its extracts prepared.

The parts of *Zaleya pentandra* herbals were collected from the West White Nile (Omdurman city) in May 2020. The plants were identified in the Department of Plant Botany. After cleaning with distilled water, the aerial components were permitted to air dry at room temperature on a sterile blotter set in the shade; each plant was spread out and allowed to air dry. Maceration was utilised by [19] to acquire the different extracts.

Plant-based chemical assays

Every measurement for every assessment was made in three distinct biological replicates. I used previously enveloped techniques(Table 1). The Phytochemical analysis of Z. pentandra ethanoic extract during initial phytochemicals screening is displayed in Table.

Totals phenolic and flavonoid content.

A review was conducted on the Total Phenolic Content (TPC), With some modifications made by [20]. I used a protocol similar to the methods documented in the literature. Were determined by the absorbance at 760 nm of gallic acid equivalents (GAE) per gram. [21], The flavonoid content(TFC) evaluated used the colourimetric method with aluminium chloride, and the result was reported per mg of quercetin equivalents extract (mg QE /g).

Total flavonols (TFs) and tannins contents (TC).

Utilizing minor modifications, the TFs were conducted precisely as outlined in reference [22], adhering to the protocol detailed in reference [23], to estimate the TC. The solution's absorbance at 500 nm was recorded, and the results were expressed as milligrams of catechin equivalent per gram of extracts (mg CE/g).

Totals carotenoid content(TCC)

The TCC protocol was outlined by [24] and modified to quantify the TCC. With β-carotene, an atypical calibration curve was drawn. The findings were expressed as Beta Carotene Equivalents (β-CE/g) weight of the extract (μgβ-CE/g).

HPLC-Mass analysis of phytochemical compounds

Polyphenolics Analysis was conducted using HPLC-Mass for a 2020 system. The information in the experiment corresponded with those reported by [23]. Peaks compared to standard pure phenolic fractional chromatograms to retention time (RT) in minutes. An instrument made by Shimadzu (Kyoto, Japan) was used

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for the mass spectrometric analysis. Mass spectrum data covering amass ranges of 50–1500 m/z were recorded, and the compounds were made more understandable using the particular -ve ionisation modes, [M−H] (m/z).

Analysing Biology

Every measurement was done three times for every evaluation.

Antioxidants Activity

Through slight modifications to the established protocol, the antioxidant capacity of IC_{50} was assessed for different plant extracts using Di 4-test-octylPhenyl -1-PicrylHydrazyl (DPPH) and ferric reducing antioxidant power (FRAP). This method was chosen for its ability to gauge drug potency and effectiveness, indicating the amount of medication required to halt the progression of biological activity [25]. The extract capacity to scavenge the stable radical DPPH was then assessed using the absorbance of the resultant solution at 517nm. IC_{50} has been applied to express the activity in µg/ml. According to [26]. Methodology: the oxidants convert highly coloured blue-green radical cation of A zino Bis-3ethylbenzo Thiazoline 6 –sulfonic acids (ABTS) test was carried out. Six minutes later, the substance absorbed was measured at 735nm; Antioxidant was expressed per IC_{50} (mg/mL).

Growth conditions and microbial strains.

The microbial growth was approved [24]. Using Mueller Hinton (MH) agar In Petri dishes, the test bacteria were cultured and incubated for a full day. The next step involved creating an MH broth culture in 3 ml, kept at 37°C and 200 RPM for 24 hours. Once the suspension had solidified, 100 µL was applied to the agar surface. Following a five-minute interaction, sixty-seven-millimeter wells were excavated, and seventy-five microliters of sample were added to each well. The negative control was achieved by using Di-Methyl Sulfoxide (DMS). Depending on the microorganism being tested, in an oven set to 38°C or 31°C for 24 or 48 hours, incubation occurred at + 4°C over 4 hours. Gram (+ve) Bacteria, S. aureus, B. subtilus, E. faecalis, and the Gram (-ve) bacteria E. coli, P. aeruginosa, S. Enteritidis that demonstrated extract sensitivity were particular to control a most miniature inhibition zone and antibiotic levels. The fungal strains were cultivated on agar at 37°C up to the progress completion. To get a solution equal to 106 spores /ml, a density was adapted from 0.08 to 0.10 toward measured antimicrobial activity, and the diameter of an inhibition region of the test tube was measured.

Mini Bacterial Content (MBC) and Mini Inhibitory Content Ratio (MIC) determination.

The ratios of Mini Bacterial Content (MBC) and Mini Inhibitory Content ratio (MIC), MIC/ MBC and MBC/MFC of five Zaleya pentandra extracts (ZPE), ethanol, hexane, acetone, ethyl acetate, and methanol for the first time, were determinates. The microdilution method determined the minimum inhibitory concentration (MIC) extract that stopped the microorganism's growth in a sterile 96-well microplate with a final volume of 200 µl per well. Each extract was diluted to a stock solution (125 mg/ml) in Di-Methyl Sulfoxide (DMS), which confirmed very little antimicrobial activity. The extracts were made into two-fold serial dilutions, ranging from (0.98 -125) mg of extracts per mg/ml in DMS. After 48 hours of incubation at 37°C, the samples displayed clear fluid with no turbidity or discernible microorganism growth. The sample with low concentration (High dilution) was determined by interpreting the MBC values, and an initial well that showed no discernible growth defined the minimum fungicidal concentrations (MFC). These were then verified through a serial cultivated in agar dextrose ten µl, followed by an incubation period of three to four days at 30°C. It was alleged that the minimum fungicidal concentrations are the lowest content that stopped mycelium growth. Appreciate [27,28].

Analysis of pharmacokinetic profiles

The pharmacokinetic profiles of the most significant typical substitutes were examined in silico using operational data sources that approximated the pkCSMs.(https://pkcsm.biosig.unimelb.edu.au.)

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Statistical analysis

One-way analysis on an ANOVA table and Tukey spathic analysis were used to determine significant differences between treatments using IBM SPSS Statistics20 [29].

Results and Discussion

Phytochemicals analysis.

The phytochemicals in Z. pentandra extracts are evaluated qualitatively in the current study, summarising the results in Table 2. The Table shows ZPE yields, total condensed tannin (TC), Total Carotenoid Contents (TCC) and ZPE yields. (2) summarises First, the polyphenolic levels were assessed using five different extracting solvents: TPC, TFC, TFs, TCC, and TC, and the yields (%)show that acetone extract had significantly (P≤0.05) higher (323.06 ±1.74 mg GAE /g) of TPC and also ethyl acetate extract had significantly (P≤0.05) higher (220.06±1.00 mg GAE /g) of TPC. Hexane (134.01±1.84 mg GAE /g), ethanol (123.06±1.40 mg QE /g), and methanol (122.06±1.74 mg GAE /g) were the following three compounds, in that order. Furthermore, the highest TFC was found in acetone (144.5±1.00 mg QE /g), which was a significant difference (P ≤0.05). From ethyl acetate (123.5±1.04 mg GAE /g) and hexane (75.02±1.70 mg QE /g). The sample with the lowest TFC appeared in ethanol and methanol extract, which differed significantly (P ≤ 0.05). Some significant variations (P ≤ 0.05) of ethyl acetate extracts (123.06±1.22 (mg QE /g) of TFs, acetone (43.06±1.66 mg QE/g) of TFs, and methanol (42.06±1.70 (mg QE /g) was the highest TFs.Furthermore, ethanol and hexane extracts presented the lowest (p ≤ 0.05) levels. The TC from hexane (55.5±1.10 (mgβ-CE/g) and those from ethanol (25.5±1.04 mgβ-CE/g) and acetone (15.5±0.78 mgβ-CE/g) extracts were found to differ statistically significantly at P≤0.0.5, Particularly, the ethanoic and hexane extracts had showed lowest levels. The TC extract ion process displayed a significant variance between the extracted results obtained with hexane, which was the most efficient solvent. The recorded 23.06±1.85 mg CE /g of TC was not found in the acetone and ethyl acetate extracts, respectively. Moreover, the yields (gram/100g) of the diverse *Z. pentandra* extracts, Hexane and ethyl acetate showed lower yields. In contrast, ethanol extract recorded the highest yields (23.88%), followed by acetone (22.74%) and methanol (8.23%), respectively.

Table. (3) showed the molecules that were identified to be the primary sources of acetone ZPE were β-Sitosterol (417.5±0.44 µg/g), which 2Hydroxy-N followed-[(1R)-1-phenylmethyl Benzamide (401.5±0.33 µg/g), phthalic acid, bis-7-methyl octyl ester (400.5±0.51µg/g), dioctyl phthalate (407.5±0.04 µg/g), Thiodiglycol (307.5±0.54 µg/g), and 1,2-benzene dicarboxylic acids (201.5±1.50 µg/gram).

Activity of antioxidants

Three in vitro analyses were investigated to assess the antioxidant activity of several ZP herbal extracts by using A zino Bis-3ethylbenzo Thiazoline 6 –sulfonic acids (ABTS) and 2,2-di(4-tert-octylphenyl)1-picryl-Hydrazyl (DPPH). The outcomes of the antioxidant ability of IC_{50} are displayed in (Table 4). The results indicated that the several extracts with excellent activity, methanol (IC_{50} 145.33 ±3.21 µg/ml) and ethyl acetate (IC_{50} 64.63± 2.08 µg /ml), had less noticeable difference in the potential scavenging capacity than the other extracts measured. ABTS of the various ZP extracts was still a fascinating technique for determining the efficacy of antioxidant substances and confirmed the antioxidant activity of five solvent extract fractions. FRAP test revealed that differences significantly at (p ≤ 0.05) were detected in antioxidant activities between the hexane and methanol extracts compared to the other extracts, as indicated by their respective, the hexane extracts EC50 record value (126.40 ±4.51µg/mL) of FRAP and (115.33±3.5 µg/ml) of Methanol Antioxidant Activity (IC50 µg/ml), which are lower. The ethanol extract originated in the second with an EC50 of 223.12 ±3.20 µg/ml. Showed that the extracts with the highest DPPH scavenging activity were acetone extract of ZP (IC50 101.33 ±2.08µg/ml) and methanol (IC50 60.33 ±2.08µg/ml).

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Table 1. Phytochemical screening results from *Zaleya pentandra* extract

Phytochemical	Results
Saponins	++ve
Alkaloids	++ve
Flavonoids	++ve
Glycosides	+++ve
Amino acids	+++ve
Carbohydrates	+++ve
Tannins	+++ve
Polyphenols	+++ve

*The sign (++ve) means moderate presence (positive at10 min), while plus sign (+++ve) a high amount (positive at 5min).

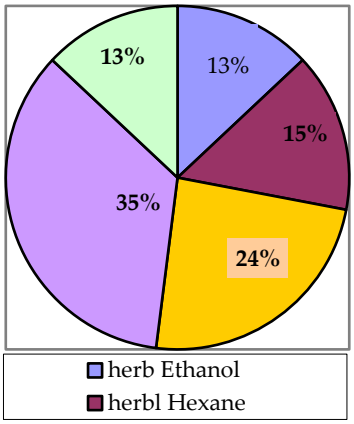

Figure 2. Total of phenols compounds %

Table.2. phytochemical analysis of various ZP extracts and the extraction yield (%).

Fractions	TPC(mg GAE/g)	TFC(mgQE/g)	TFs(mgQE/g)	TC(mgβCE/g)	TCC(mg CE/g)	Yields(%)
Ethanol	123.06±1.40^{d}	55.5±1.75^{d}	23.06±1.74^{c}	25.5±1.04^{c}	22.06±2.70^{a}	23.88^{a}
Hexane	134.01±1.84^{c}	75.2±1.70^{c}	20.06±1.54^{c}	55.5±1.10^{a}	23.06±1.85^{a}	2.75^{d}
Ethyl Acetate	220.06±1.00^{b}	123.5±1.04^{b}	123.06±1.22^{a}	44.5±1.66^{b}	-	5.85^{c}
Acetone	323.06±1.74^{a}	144.5±1.00^{a}	43.06±1.66^{b}	15.5±0.78^{d}	-	22.74^{a}
Methanol	122.06±1.74^{d}	53.5±1.02^{d}	42.06±1.70^{b}	14.8±1.50^{d}	12.06±1.74^{b}	8.23^{b}

The mean ±SD of 3 replicates constitutes each data point. Based on Duncan's multiple range test, the difference letter, a,b,c and d mean values are significantly different at $p \leq 0.05$.

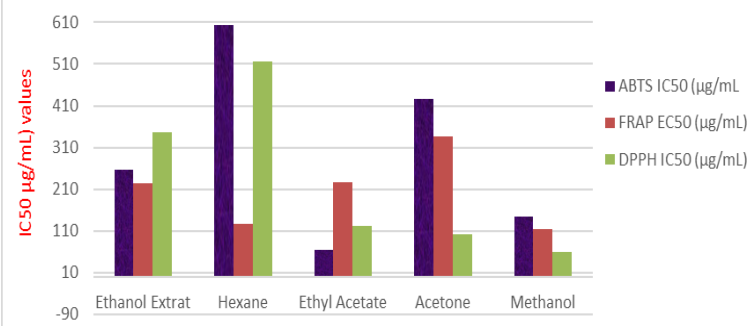

Figure 3. Antioxidant activity (IC_{50} µg/mL) values

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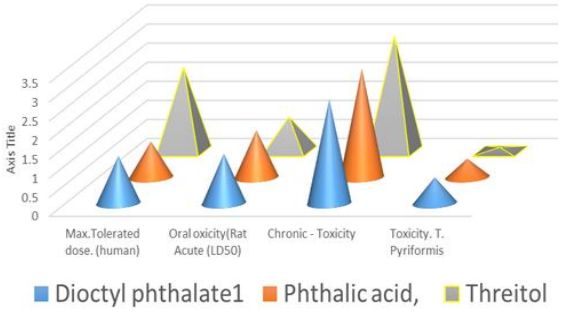

Figure 4. Toxic main compounds

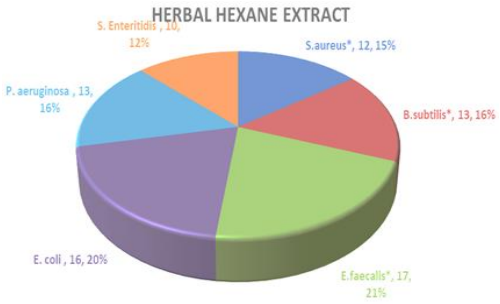

Figure 5. Examination of the Antibacterial activity of herbal hexane extract

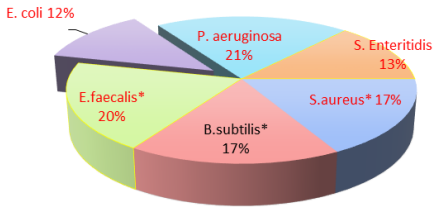

Figure .6. Examination of Antibacterial activity of herbal ethyl acetate extract

Table 3: Chemical Compounds of AZPE identified through HPLC-MS analysis

No	Compounds	Quantity in µg/g extract	MS[M-H]-m/z	RT(min)
1	1,2-benzene dicarboxylic acid	201.5±1.50	90	13.108
2	2-Methoxy-4-vinyl phenol	303.5±0.50	189	2.176
3	2Hydroxy-N-[(1R)-1-phenylethyllBenzamide	401.5±0.33	174	8.178
4	Thiodiglycol	307.5±0.54	169	2.178
5	Dioctyl phthalate	407.5±0.04	71	8.180
6	1,3-benzene dicarboxylic acid	201.5±1.30	90	13.108
7	Phthalic acid,bis-7-methyloctylester	400.5±0.51	198	6.198
8	1,4-benzene dicarboxylic acid	201.5±1.50	90	13.108
9	4-Fluoroaniline	117.5±0.54	50	4.177
10	beta-Lactose	23.3±0.52	13	2.278
11	Epicatechin	270.5±0.50	180	12.176
12	β-Sitosterol	417.5±0.44	190	23.175
13	D-Threitol	107.5±0.54	70	2.173

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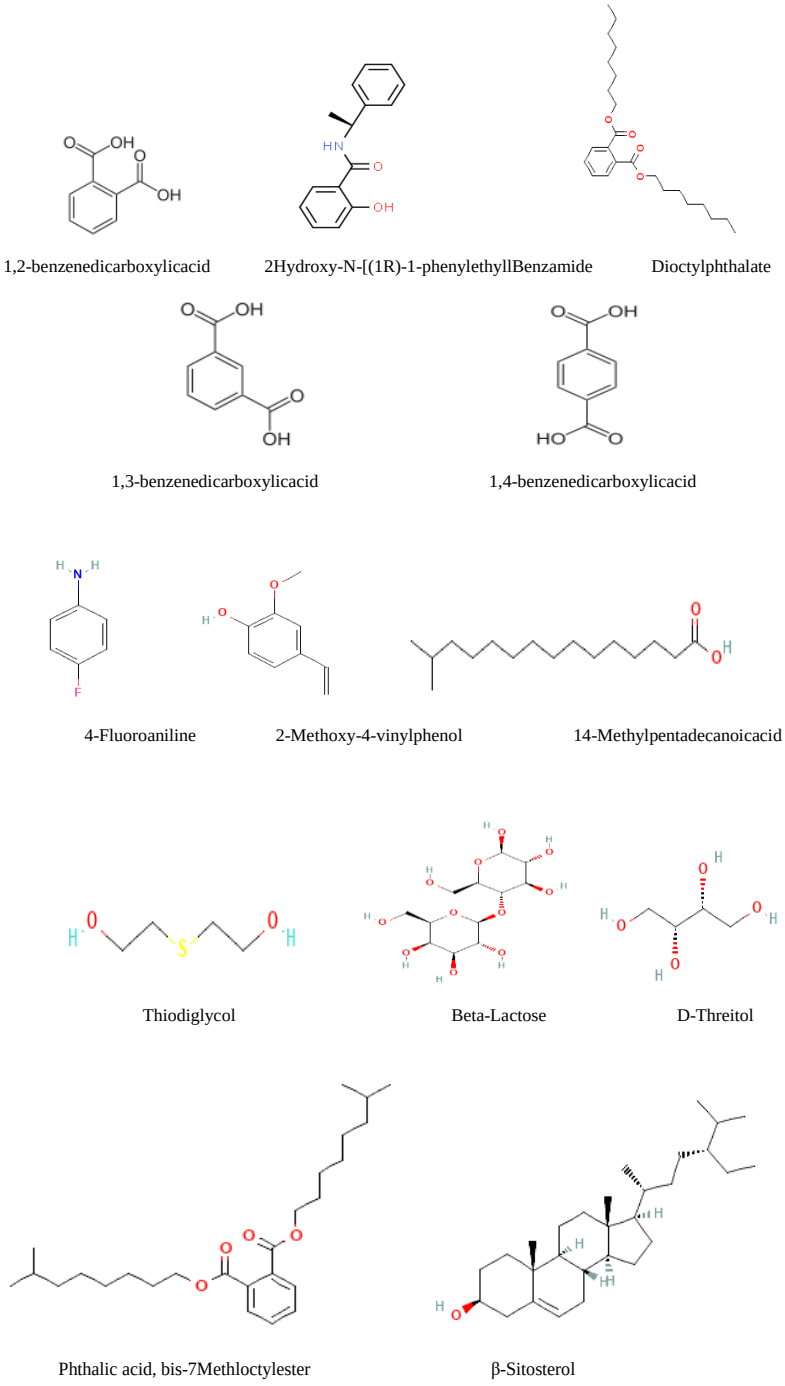

Figure 7. Structures of some phytochemical compounds from *Z. pentandra* extracts

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Table. 4a. The absorption and Metabolism of compounds identified from AZPE using the pkCSM server's pharmacokinetic profile characteristics

Compounds	1,2-benzene dicarboxylic acid (1)	2Hydroxy-N-[(1R)-1-phenylmethyl Benz amide (3)	Dioctyl phthalate1 (5)	Phthalic acid, bis-7-methyl octyl ester (7)	4-Fluoroaniline (9)	Beta-Sitosterol (10)	D-Threitol (13)
Absorption							
Intestinal absorption (human)	75.609	91.278	90.874	90.76	92.525	94.464	61.776
Skin Permeability	-2.735	-3.051	-2.672	-2.684	-3.054	-2.783	-3.509
Water solubility	-2.668	-3.113	-6.546	-6.839	-0.882	-6.773	-0.005
Caco2 permeability	0.641	1.219	1.381	1.416	1.614	1.201	0.429
P. glycoprotein Inhibitor 1	No	No	Yes	No	No	Yes	No
P. glycoprotein Inhibitor 11	No	No	Yes	Yes	No	Yes	No
P. glycol protein substrate	No	Yes	No	No	No	No	No
Metabolism							
Cytochrome P-450-CYPIA2	No	Yes	No	No	No	No	No
Cytochrome P-450- CYP2C19	No	Yes	Yes	No	No	No	No
Cytochrome P-450-CYP2C9	No	Yes	No	No	No	No	No
Cytochrome P-450- CYP2D 6	No	No	No	No	No	No	No
Cytochrome P-450- CYP3A	No	No	No	No	No	No	No
SubstrateCYP2D 6	No	Yes	No	No	No	No	No

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Table 4 b. The Toxicity of compounds identified from AZPE using the pkCSM server's pharmacokinetic profile characteristics

Compounds	1,2-benzene dicarboxylic acid (1)	2Hydroxy-N-[(1R)-1-phenylmethyl Benz amide(3)	Dioctyl phthalate1 (5)	Phthalic acid, bis-7-methyl octyl ester (7)	4-Fluoroaniline (9)	Beta-Sitosterol (10)	D-Threitol (13)
Toxicity							
Skin Sensitization	No	No	No	No	Yes	No	No
Hepatotoxicity	No	No	No	No	No	No	No
Toxicity AMES	No	No	No	No	Yes	No	No
HERG inhibitor1	No	No	No	No	No	No	No
HERG inhibitor II	No	No	Yes	Yes	No	Yes	No
MaxTolnated dose. (Human)	0.582	0.321	1.246	0.944	0.514	-0.621	2.207
Oral toxicity(Rat Acute(LD50)	1.449	2.012	1.305	1.236	2.253	2.552	0.9
Chronic - Toxicity	2.165	1.91	2.731	2.86	1.947	0.855	3.023
Toxicity. T. Pyriformis	0.281	1.306	0.683	0.493	-0.012	0.43	0.106
Toxicity-Minnow	2.378	1.036	-3.04	-4.25	2.066	-1.802	4.153

Table .4 C. The Distribution and Excretion of compounds identified from AZPE using the pkCSM server's pharmacokinetic profile characteristics

Compounds	1,2-benzene dicarboxylic acid (1)	2Hydroxy-N-[(1R)-1-phenylmethyl Benz amide (3)	Dioctyl phthalate1 (5)	Phthalic acid, bis-7-methyl octyl ester (7)	4-Fluoroaniline (9)	Beta-Sitosterol (10)	D-Threitol (13)
Distribution							
VDss (human)	-1.775	0.162	0.35	0.193	0.065	0.193	- 0.466
Fractions unbound (human)	0.497	0.12	0	0	0.525	0	0.916
Permeability BBB	-0.038	0.376	-0.23	-0.283	-0.248	0.781	- 0.983
Permeability CNS	-2.891	-2.174	-2.329	-2.186	-1.877	-1.705	-3.937
Excretion							
Total of Clearance	0.682	0.272	1.964	1.451	0.369	0.628	0.791
Renal substrate OCT 2	No	No	No	No	No	No	No

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Pharmacokinetics Analysis

The selected photo compounds showed good intestinal absorption patterns and a moderate level of aqueous solubility, as shown in Table. (4) a shows the absorption and Metabolism of compounds identified from AZPE using the pkCSM server's pharmacokinetic profile characteristics. To enhance the prediction of the absorption of orally controlled drugs, the Caco-2parameter was observed for the in vitro standard of a human intestinal mucosa by measuring log Papp values > 0.90 of the coefficient. First, phthalic acid and bis-7-methyl octal ester compounds had excellent Caco-2 permeability (1.416), while other components in the selection demonstrated moderate Caco-2 permeability. The range of -2.76 2 to -3.509 cm/s for skin permeability, and no P-glycoprotein was present other than compounds No.3 and inhibitors. To quantify a molecule's potential as an effective oral drug, it is essential and crucial to perform computational predictions of drug-likeness and pharmacokinetics at a near-lire phase of the drug development and discovery process [4, 28.30]. Table 4 b shows the Toxicity of compounds identified from AZPE; except compound (9), which was present at both AMES toxicity and skin sensitisation, the compounds, especially those with AMES toxicity, did not show any specific toxicity, hepatic toxicity or skin sensitisation toxicity, according to the analysis of the toxicity profile using various parameters—the Distribution and Excretion of compounds identified from AZPE on Table .4 C. The predicted values of VDss (high flog VDss > 0.45 and low if <-0.15 Ref) show that compounds 1, 3, 5, 7, 9, 10, and 13 were easier to disperse in tissue than in plasma. The inability to interact with the pharmacological target has been observed to be facilitated by good unbound fraction scores. Compounds (3 & 10) and CNS permeability values were the only two that showed variable and negative BBB, indicating that the other compounds could pass through, the CNS and the BBB, in that order. The human body metabolised some of the compounds considered, according to view metabolism reactions, particularly those related to Cytochrome P450 enzymes, which had been expected with the selected molecules. Not every

The substance is an OCT2, as determined by testing on the clearance parameters (renal and hepatic). The dried herbal Zaleya pentandra (L.) powder in Sudan with millet beer (Mixture) treats gonorrhoea. In addition, it helps with fungal infections, hyperlipidemia, and hyperpigmentation; the plant was used in Pakistan to treat a wide range of different diseases [18]; a scientific project on several solvent extracts of Z. pentandra has been conducted in this study five solvents are used of Z. pentandra extracts (ZPE) (Ethanol, hexane, Ethyl acetate, acetone, and ethanol). The outcomes of the phytochemical analysis displayed that the total polyphenol content (TPC) on herbal extracts containing acetone and ethyl acetate had a total flavonoid content (TFC) was significantly ($P \leq 0.05$) higher. The most appropriate extracts were subjected to an HPLC-Mass spectral analyser, confirming the identification of thirteen compounds of β-Sitosterol and Dioctyl phthalate. Based on colourimetric analyses, the work shows that ZP extracts showed a substantially greater TPC, especially in ethanol and acetone extracts with high TFC levels. Then, component identification was confirmed through spectral analysis using HPLC-MS. Naturally occurring polyphenols called flavonoids are well-known for their wide range of phytonutrients. According to [31], these photo constituents are responsible for biological activities similar to flavonoids and tannins that contribute to cytotoxic, antimicrobial, free radical elimination, and anti-inflammatory effects.

According to [32], the molecules γ-sitosterol and 2-hydroxy hexadecanoic acid, 14-methyl acid, have anti-oxidant, anti-diabetic, anti-viral, anti-bacterial, and neuroprotective qualities. The observed outcomes may be explained by the fact that flavonoid glycosides and their glycoside derivatives were more readily extracted from secondary metabolites like polar carbohydrates and glycosides using polar solvents like acetone, ethanol, and water, were highly soluble in these solvents. Regarding antioxidant activity, our results showed that DPPH was only marginally ($p \leq 0.05$) more active than FRAP. However, it remained linearly significant and higher ($p \leq 0.05$) than ABTS. Furthermore, the primary contributor demonstrated the highest DPPH scavenging activity. Dioctyl phthalates, β-Sitosterol, Benz amide Phthalic acid, Thiodiglycol, 1,2-benzenedicarboxylic acid, and bis-7-methyloctyl ester were the main constituents of the ZPE. The benzaldehyde 4-methoxy, 4-fluoro aniline, and dioctyl phthalate [33] were confirmed by [34]; every compound should also be examined through in vitro analysis to verify its enzymatic potential; however, this is not feasible because of the compounds deficient concentration and their unavailability in the herbal extract. Since these compounds will predict the biological substances that drive enzyme activities, they can be virtually evaluated through in silico molecular docking studies [35]. Moreover, both ABTS free radical scavenging, phthalic acid, bis-7-methyl octyl ester, and 2Hydroxy-N-(1R)-1-phenylmethyl Benz amide. Additionally, because beta-sitosterol inhibits the synthesis of steroid hormones, it can lower testosterone, which may be helpful for

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patients with androgenic alopecia [36]. Based on in silico toxicity studies, lactose was found to be non-toxic because it belongs to Class VI, but all the best-docked compounds had low toxicity because they are in Classes [IV and V]., [37]. Based on the results in Table. (4) in silico toxicity studies, the compounds had never spotted Skin Sensitization, Hepatotoxicity, hazardous, or affecting skin allergies in the biometric analysis of the computational model. Also, AMES Toxicity was not detected in the regulatory setting for any evaluated compounds from ZP extracts. Based on our investigations, the ZP extracts present an intriguing prospect for developing novel antibiotics and antioxidants designed for industrial food and pharmaceutical applications. Here, we will discuss the Natural sources with high antioxidant activity, such as polyphenols.

Methanolic and ethanolic extracts of *Zalia pentandra* extract showed the highest antioxidant activity. At the same time, essential oils such as herbal oil can also be used to increase the shelf life of food.

In pharmaceutical applications

Developing new antibiotics and antioxidants for food and industrial pharmaceutical uses is a critical area of research, as these compounds play a vital role in maintaining the quality and safety of food products and improving the effectiveness of pharmaceutical treatments. Research on natural antioxidants and developing novel delivery systems remain significant areas of focus in this field.

Based on in silico toxicity in this study, a compound identified from AZPE was non-toxic because it does not evaluate the probability that a particular material is linked to skin sensitivity and Hepatotoxicity. In Sudan, the powder of Z. pentandra is used in traditional medicine to treat gonorrhoea. According to the results of this research, a can be made a drug to treat gonorrhoea as an alternative drug to ceftriaxone, which is a type of antibiotic used to treat gonorrhoea and bacterial infections. It is a type of third-generation cephalosporin family. Ceftriaxone is given either by intramuscular injection or intravenous injection. Ceftriaxone has the potential to cause a rash, diarrhoea, and a significant increase in the number of white blood cells [38]. The current study offers new information on applying ZPE in a novel drug to treat gonorrhoea and bacterial infections, which has not caused any rash or diarrhoea.

Conclusions

Our research revealed that various ZP herbal extracts exhibited higher total phenols and TFC levels, particularly in ethanol and acetone extracts. The HPLC-MS analysis identified numerous chemicals that did not cause skin sensitisation, hepatotoxicity, or dangers in the computational bioassay, with beta-sitosterol and dioctyl phthalate showing in high concentrations. TPC overlaps with TFC and TC, suggesting that the predominant phenolic components are condensed flavonoids and tannins. The extracts differ in their concentrations of the most potent antimicrobial and antioxidant events. More research is needed to refine the techniques for isolating and identifying bioactive chemicals from ZPE and industrial them as nutritional supplements, antioxidant agents, and antibiotics.

Acknowledgement

Conflict of Interest

A declaration of conflicting interests: According to the author, the work presented in the article could not have been influenced by any known fiscal conflicts or personal relationships.

Supplementary Materials

Electronic ISSN : 2656-3088
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