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Article

Evaluation of Antioxidant Capacity, Alpha-Glucosidase inhibitor, and Chemical Profiling using HRMS UHPLC-Q-Orbitrap of Purslane (*Portulaca oleracea* L.) Extract

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Abstract. Diabetes mellitus (DM), especially type 2, is a global health problem characterized by hyperglycemia. Oxidative stress is a major contributor to the complications of diabetes. One therapeutic strategy for managing type 2 DM is to inhibit the alpha-glucosidase enzyme. This study aims to investigate the antioxidant potential and alpha-glucosidase inhibitory activity of *Portulaca oleracea* L. extract, and to identify the phytochemical compounds responsible for these activities. This study was divided into 4 steps: (1) Extraction of purslane using 70% ethanol through UAE (2) Evaluation of antioxidant capacity (3) Alpha-Glucosidase Inhibitory Activity Test (4) Quantitative screening was conducted to identify the presence of secondary metabolites using HRMS UHPLC-Q-Orbitrap. The research showed that the substance possesses antioxidant capacity, with an IC50 value of 40.41 µg/mL, and also has inhibitory effects against α-glucosidase, with an IC50 value of 229.41 µg/mL. The results of UHPLC-Q-Orbitrap mass spectrometry analysis of the 28 compounds found in the purslane extract identified flavonoids, polyphenols, alkaloids, fatty acids, terpenoids, and organic acids, including chromen-4-one, apigenin, nictoflorin, gallic acid, oleamide, 3,5-dioxooctanedioic acid, and 7-deoxyloganetin that contribute to alpha-glucosidase inhibition and correlated with antioxidant capacity. We conclude that purslane extract has potential as a natural antidiabetic agent.

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1. Introduction

Alpha-glucosidase is a critical enzyme involved in carbohydrate metabolism. It catalyzes the hydrolysis of alpha-1,4-glycosidic bonds in oligosaccharides and starch, converting them into glucose [1-2]. This enzyme is located in the brush border of the small intestine and plays a significant role in the digestion of carbohydrates [3-4]. Alpha-glucosidase inhibitors are used to manage postprandial hyperglycemia in type 2 diabetes by delaying the release of glucose from carbohydrates [5-6]. These inhibitors help control blood glucose levels and considered attractive therapeutic agents [7-8]. Alpha-glucosidase inhibitors such as acarbose and miglitol are a class of oral antidiabetic medications primarily used to manage type 2 diabetes by delaying carbohydrate absorption in the intestines. While they are effective in controlling postprandial blood glucose levels, they are associated with several gastrointestinal side effects that can impact patient adherence to treatment regimens.

The most frequently reported side effects include flatulence, diarrhea, and abdominal discomfort. These symptoms arise due to the fermentation of undigested carbohydrates in the colon, leading to gas production and bloating [9-11]. Natural products, particularly those derived from plants and fermented foods, show great promise as alpha-glucosidase inhibitors with minimal side effects. Compounds like curcumin, quercetin, berberine, catechin, and various flavonoids have demonstrated significant inhibitory activity and favorable pharmacokinetic properties, making them potential candidates for safer diabetes management [12-13].

Various studies have explained the role of antioxidants in helping overcome the condition of diabetes mellitus, and this is related to the oxidative stress that occurs in diabetes due to an increase in free radicals level [14-15]. In diabetes, there is a decrease in the concentration of endogenous enzymatic and non-enzymatic antioxidants non-enzymatic antioxidants. This is accompanied by an increase in the levels of advanced oxidation products, which intensify oxidative stress [16-17]. Increased reactive oxygen species (ROS) during diabetes can modulate insulin signaling pathways, thereby contributing to the progression of diabetes and the development of diabetic vascular complications [18-19] have shown that antioxidant therapy helps repair betacell damage caused by oxidative stress,and the antioxidants help improve insulin sensitivity and reduce the diabetes complications [20-22].

There have been numerous reports regarding the side effects of conventional diabetes medications, such as acarbose. Patients often find the side effects associated with long-term use such as uncomfortable in gastrointestinal. A back to nature approach, offering minimal side effects presents a potential alternative treatment option. Purslane (*Portulaca oleracea* L.) is one plant believed to possess hypoglycemic properties.

It is one of the portulacaceae famili and has been known as a vegetable, spice and medicine. Purslane is widely distributed in tropical subtropical regions of the world. In the Middle East, Purslane is used for its various medicinal applications, including as an antiseptic, antispasmodic, diuretic, vermifuge, and refrigerant, and also as a therapeutic herb to treat skin irritations and mouth sores. Its plant extracts can be used as a bactericidal agent, as well as an aphrodisiac, a pain reliever, and anti-inflammatory agent, and it has been found to possess anti-cancer properties. Extract methanol of Purslane leaves has antioxidant properties by in vitro study. Purslane is an excellent source of several bioactive constituents, including antioxidants (alpha tocopherol, beta carotene, ascorbic acid, and glutathione) and omega 3 fatty acids (FA). Purslane is also a good source of flavonoids, terpenoids, alkaloids, phenolic acids, saponins, vitamins, and minerals [23-24].

Antioxidants found in plant-based foods are mainly derived from compounds such as phenolic derivatives, including flavonoids such as quercetin, hydroxamic well as hydroxamic acid derivatives, coumarins, tocopherols, organic acids (gallic acid), and vitamin C (ascorbic acid) Numerous studies have demonstrated the potential of these phytoconstituents as inhibitors of α-glucosidase and antioxidants [25-28]. This study aims to investigate the antioxidant potential and alpha-glucosidase inhibitory activity of purslane herb extract, and to identify the phytochemical compounds responsible for these activities. This study offers a new perspective by linking the phytochemical profile by HRMS UHPLC-Q-Orbitrap with its biological activities, supporting its use as complementary strategy for managing T2DM.

2. Experimental Section

2.1. Materials

*Portulaca oleracea (*purslane) herbs were collected from Makassar, South Sulawesi, Indonesia were collected in July 2025. Chemicals: ethanol (Merck), methanol (Merck), quercetin (Sigma Aldrich), Enzyme α-glucosidase (Sigma Aldrich), para-nitrophenyl-α-D glucopyranoside (SigmaAldrich), Acarbose (Sigma-Aldrich),potassium dihydrogen phosphate (Merck), sodium carbonate (Merck), dimethylsulfoxide.1,1- diphenyl-2-picrylhydrazyl (DPPH) (Sigma-Aldrich), DMSO (Merck). Instruments: Ultrasonic Cleaner (Krisbow), rotary evaporator (IKA), micropipette (Eppendorf), microplate reader (SpectroStar Nano, BMG Labtech), UHPLC-Q-Orbitrap-MS/MS (Thermo Scientific)

2.2. Methods

2.2.1. Preparation of Purslane herb Extract

The plant species used in this study, taxonomically verified at the Natural Product Laboratory, Faculty of Pharmacy, Universitas Muslim Indonesia, Makassar, Indonesia (specimen number 0004/C/UD-FF/UMI/X/2022). Purslane herbs are sorted, dried, and powdered. The sample powder was extracted by UAE at temperature 50^0C and extraction time 30 minutes using ethanol. Subsequently filtered, filtrate was collected and concentrated through a vacuum evaporator to obtain a thick ethanol extract and then in fresh drying to obtain a dry extract.

2.2.2. Evaluation of Antioxidant Capacity

The antioxidant activity assay method used DPPH free radical scavenging method adopted with slight modifications [29]. A 20 µL sample solution was pipetted in a Eppendorf tube and then180µL of 150µmol/LDPPH solution was added to each solution. The control solution consisted of 20 µLmethanol and 180 µL of 150µmol/L DPPH solution, while the blank solution consisted of 200µL methanol p.a.The solution was shaken for 60 sec and then incubated at room temperature in a dark room for 30 min. Each assay solution was measured for its absorbance at a wavelength of 514 nm.Each assay was carried out in triplicate, and the standard deviation was measured for each sample. The IC50 value was calculated based on the percentage of DPPH scavenging from each sample solution concentration with the formula:

$$\text{DPPH scavenging (\%)} = \frac{(\text{Absorbance of control solution} - \text{Absorbance of Sample})}{\text{Absorbance of control solution}} \times 100$$

After obtaining the percentage of DPPH scavenging for each concentration, the equation y=a+bx isdetermined by a regression calculation where x is the concentration (µg/mL) and y is the percentage of DPPH scavenging (%). Antioxidant activity is expressed by an effective concentration of 50% (IC_{50}).

2.2.3. α-glucosidase Enzyme Inhibition Activity Assay

The α-glucosidase inhibitory activity assay was carried out using the spectrophotometric method, where the absorbance was read with a microplate reader [30]. The solution mixture consisting of 30 µL of sample solution, 36 µL of phosphate buffer (pH 6.8), and 17 µL of pNP-G substrate (5 mM) was incubated for 5 min at 37°C then added 17 µL of α-glucosidase enzyme solution (0.12 Unit/mL) and incubated for 15 min at 37˚C. After 15 minutes of incubation,100µL of 267mM Na_2CO_3 was added to stop the enzyme reaction, and the absorbance of the p-nitrophenol produced from the enzyme reaction was read using a microplatereader. In the sample control solution, the Na_2CO_3 solution was added before adding the α-glucosidase enzyme so that the reaction did not occur. Each assay was carried out three times (triplication), and the standard deviation was measured for each sample. The percentage of α-glucosidase inhibition was calculated by the formula:

$$\alpha - \text{glucosidase inhibition } (\%) = \frac{(\text{AB blank} - \text{AB sample})}{\text{AB blank}} \times 100$$

where AB blank is the absorption of enzyme activity without inhibitor corrected by blank control, and AB sample is the absorbance of sample corrected by sample control. The IC50 can be calculated using the regression equation y = a + bx, with sample concentration on the x-axis and α-glucosidase inhibition (%) on the y-axis. The IC_{50} value was calculated by the formula: (50 – a)/b.

2.2.4. Compound Profiling using UHPLC MS/MS-Q-Orbitrap

The instrument used was UHPLC-Q-Orbitrap-MS/MS (ThermoScientific) equipped with heat electrospray ionization (HESI). A stock solution of purslane herb in methanol for chromatography was prepared at a concentration of 1.0 µg/mL and vortexed. After that, 1mL of the stock solution was filtered using a 0.2 µm PTFE membrane and transferred to a UHPLC-MS/MS vial. The sample solution was then injected into a UHPLC-Q-Orbitrap-MS/MS system, using a volume of 3 µL. It was separated using a 100 x 2.1 mm Accucore Phenyl-Hexyl column, with a particle size of 2.6 µm, supplied by Thermo Scientific, at a flow rate of 0.3 ml/min, with a gradient between 0.1% formic acid in distilled water (solvent A) and 0.1% formic acid in methanol (solvent B). Elution was carried out in a linear gradientat 5% of solvent B for 0–6 min, then from 5 to 90% of solvent B for 1-16 min, held at 90% of solvent B for 16-20 min and finally a linear gradient at 5% of solvent B for 20-25 min.

Positive electrosprayioni-zation (ESI+) mode was used for mass spectrometric analysis, with collision energies of 18, 35, and 53 eV. The following parameters were set on the instrument: MS full scan range, *m/z* 66.7–1000 Da; spray voltage, (+) 3.30Kv; resolving power, 70,000 FWHM; column temperature 30˚C; capillary temperature 320˚C; sheath and auxiliary gas,15 and 3 ml/min. In the Xcalibur, instrument spectra were obtained, providing information on retention time, peak intensity, and m/z weights, which were measured using equipment from Thermo Scientific. The Compound Discoverer software from Thermo Scientific was then utilised to examine untargeted metabolomics data, and it is directly linked to online databases such as Chemspider and MZcloud, enabling the identification of the discovered compounds. This test was performed in three replicated [31].

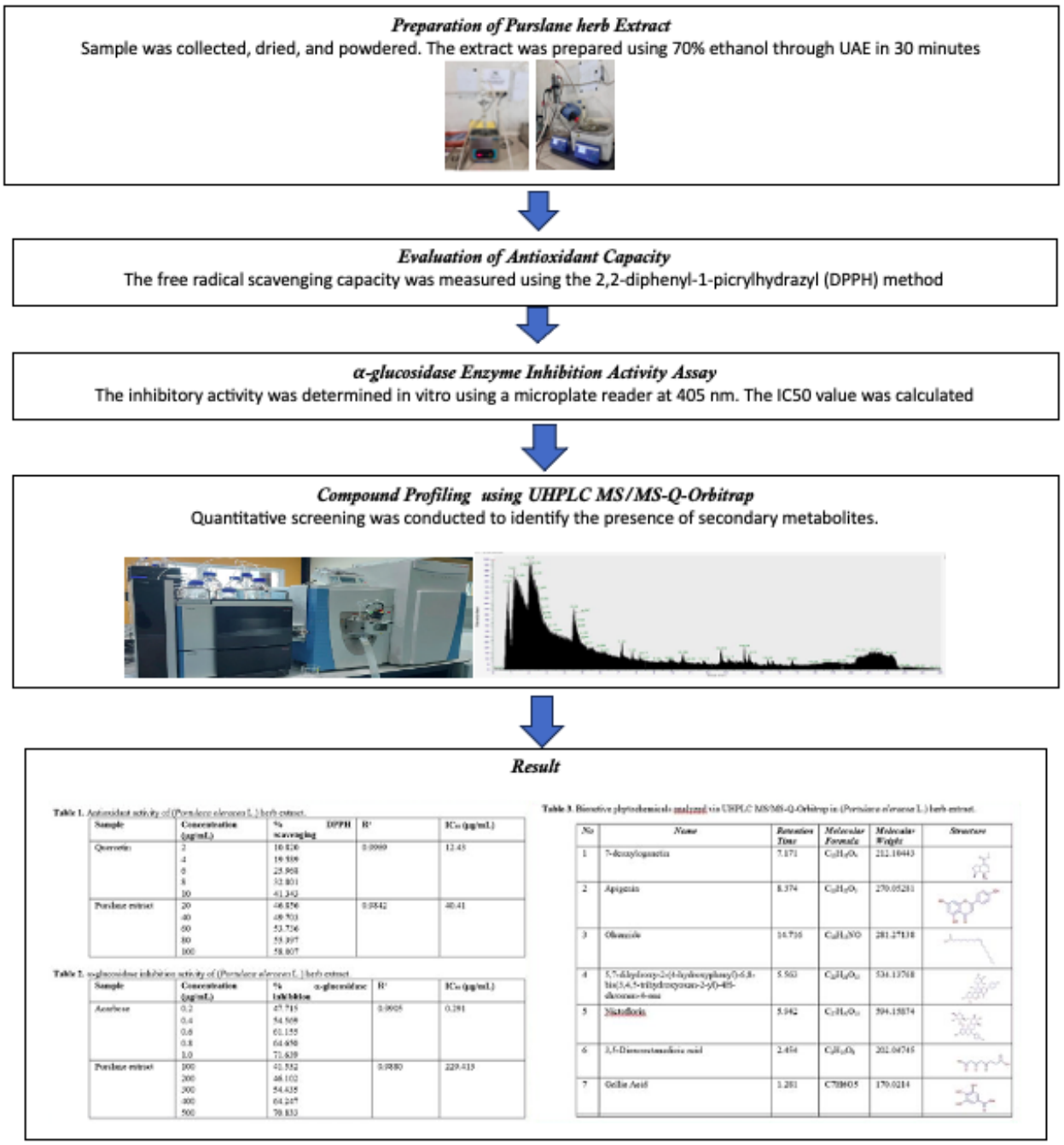


Figure 1. Flowchart of Research

3. Results and Discussion

3.1. Extraction Process of Purslane Herb

The extraction method used in this research is the *Ultrasound-Assisted Extraction (UAE)* method. The UAE was chosen because the process is easy and does not take a long time that may damage chemical compounds that have antioxidant activity contained in purslane herbs. Ethanol is a semipolar compound that has a hydroxyl group that is nonpolar and has a nonpolar test, so that it can extract polar and nonpolar antioxidant compounds in purslane plants. The antioxidant compounds in

purslane are derived from flavonoid compounds which are the substance, where in several studies it has been shown that flavonoids are the main bioactive of purslane plants. The result of the UAE process was filtrate form. After that, the filtrate was concentrated using a rotary evaporator with a vacuum pump. The vacuum pump on the rotary evaporator can carry out solvent evaporation below the boiling point of the solvent, and the evaporation process can take place more quickly. The temperature is 50°C because with that temperature, we can keep the active compounds contained are not damaged by heating. After evaporation, a thick ethanolic extract of purslane herb was obtained.

3.2. Antioxidant Capacity Assay

Purslane is one of the plants that has become a good source of flavonoids, terpenoids, alkaloids, phenolics, saponins, vitamins and minerals. Other compounds such as carotene, other components such as carotene, glutathione, melatonin and high fatty acid content, all of the compounds contained contribute to antioxidant properties and free radical scavenging activity. The antioxidant content and nutritional value of purslane are important for human consumption, nutritional potential, and potential use of plants for the future.

According to previous study, flavonoids are antioxidants that work as pancreatic lipase inhibitors and reduce appetite [29]. Pancreatic lipase is an enzyme that has a role as a catalyst for the hydrolysis of triglycerides into free fatty acids and glycerol, which are absorbed by the body. When triglyceride hydrolysis is inhibited through lipase inhibition, it can reduce and prevent obesity. Flavonoids can also reduce the accumulation of liver lipids, reduce glucose absorption, and can inhibit the breakdown of polysaccharides into monosaccharides, which causes reduced fat absorption, thereby reducing body weight.

In this study, the antioxidant activity test purslane herb ethanol extract was carried out by the method testing using DPPH. Antioxidant testing using DPPH is one of the quantitative test methods to determine the amount of activity of purslane herb ethanol extract as an antioxidant compound. This method is a conventional method and has long been used to determine the activity of antioxidant compounds. In addition, the process is also easy, fast and sensitive to test the antioxidant activity of plant extracts using DPPH by microplate reader [29].

Table 1. Antioxidant capasity of (*Portulaca oleracea* L.) herb extract

Sample	Concentration (μg/mL)	Mean % DPPH scavenging ± SD	R^2	IC_{50} (μg/mL)
Quercetin	2	10.820 ± 0.1113	0.9969	12.43
	4	19.589 ± 0.0064		
	6	25.968 ± 0.0036		
	8	32.801 ± 0.0108		
	10	41.343 ± 0.0046		
Purslane extract	20	46.856 ± 0.0173	0.9842	40.41
	40	49.703 ± 0.0056		
	60	53.736 ± 0.0122		
	80	55.397 ± 0.0105		
	100	58.007 ± 0.0070		

Concentration series variations are made to obtain a linear regression equation so that the IC50 value can be determined, where the IC50 value is calculated using the linear regression line equation between the concentration of the test compound as the x-axis and the percentage of inhibition as the y-axis. In this study, quercetin was used as a standard because it is a natural antioxidant that has been

proved as strong antioxidant. Testing the antioxidant activity as standard solution of quercetin in 5 series concentration. The antioxidant activity of a material is very strong if the IC50 value is <50 ppm, strong if the IC50 value is 51-100 ppm, moderate if the IC50 value is 101-250 ppm, weak if the IC50 value is 251-500 ppm and is not active if IC50 value >500. The IC50 value of purslane herb ethanol extract was 40.41 µg/mL while this value was included in the category of very strong antioxidant.This is in line with previous research that phenolic compounds, flavonoids, tannins, and omega-3 fatty acids are strong antioxidant [32-33].

This extract has been reported to reduce lipid peroxidation, as measured by decreased levels of Malondialdehyde (MDA), a marker of oxidative stress, in the liver tissue of diabetic rats. Simultaneously, the extract enhances the body's endogenous antioxidant defenses, including increased activity of key enzymes such as Superoxide Dismutase (SOD), Catalase (CAT), and Glutathione (GSH). These antioxidant and anti-inflammatory activities are closely interrelated. The antidiabetic effect of P. oleracea Polysaccharides (CPOP) is explicitly mediated through the reduction of oxidative stress (decreased MDA and increased SOD) and suppression of inflammation (decreased pro-inflammatory cytokines Tumor Necrosis Factor- (TNF-alpha) and Interleukin-6 (IL-6) . These mechanisms are crucial in mitigating diabetic complications, such as diabetic vascular inflammation. In addition, P. oleracea extract has shown neuroprotective effects, protecting neural tissue from hypoxic damage, which is also attributed to its ability to scavenge free radicals.

3.3. Alfa-Glucosidase Enzyme Activity Assay

Tables 2 display the results of the α-glucosidase inhibitor activity test using an ethanol extract of metabolites from the Portulaca oleracea L and acarbose as comparators. IC50 results on Portulaca oleracea extracts showed that inhibition of the α-glucosidase enzyme at concentration of 229.413µg/mL Acarbose as a comparison in this study to competes with carbohydrates for binding to the active sites of α-glucosidase enzymes such as sucrase, maltase, and glucamylase By binding to these enzymes, acarbose prevents the hydrolysis of oligosaccharides into absorbable monosaccharides like glucose. While the function of p-nitrophenyl-D-glucopyranosida as a substrate resembles that of carbohydrate in the body, the enzyme degrades the substrate into glucose and p-nitrophenol [34-37].

Table 2. α-glucosidase inhibition activity of (*Portulaca oleracea* L.) herb extract

Sample	Concentration (µg/mL)	Mean % α-glucosidase inhibition ± SD	R^2	IC_{50} (µg/mL)
Acarbose	0.2	47.715 ± 0.0087	0.9905	0.291
	0.4	54.569 ± 0.0117		
	0.6	61.155 ± 0.0187		
	0.8	64.650 ± 0.0629		
	1.0	71.639 ± 0.0075		
Purslane extract	100	41.532 ± 0.0060	0.9880	229.413
	200	46.102 ± 0.0070		
	300	54.435 ± 0.0060		
	400	64.247 ± 0.0056		
	500	70.833 ± 0.0075		

Purslane herb has been extensively studied for its potential health benefits, including its role as an alpha-glucosidase inhibitor. Alpha-glucosidase inhibitors are important in managing postprandial blood glucose levels, making them valuable in the treatment of diabetes. Various solvent extracts of

purslane, particularly ethyl acetate and acetone extracts, have shown potent alpha-glucosidase inhibitory activities. Seven major compounds isolated from purslane, including quercetin, rosmarinic acid, and kaempferol, exhibited significant alpha-glucosidase inhibitory effects [1].

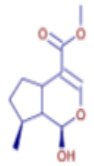
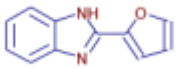
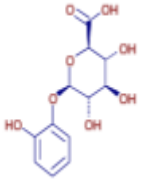
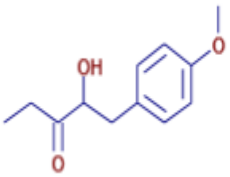
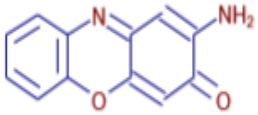
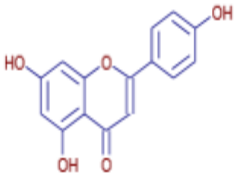
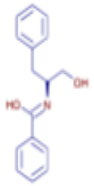
Molecular docking studies have supported the strong binding abilities of these compounds to alpha-glucosidase, suggesting a higher antagonistic effect compared to common inhibitors. The inhibition of alpha-glucosidase by these compounds helps in reducing the breakdown of carbohydrates into glucose, thereby managing postprandial blood glucose levels [38]. The inhibitory effects of purslane extracts on alpha-glucosidase were found to be more potent than those on alpha-amylase, indicating a stronger potential for managing blood glucose levels through alpha-glucosidase inhibition [39]. *Portulaca oleracea* L. extract has shown clinical effectiveness in animal models, as evidenced by decreased fasting blood glucose (FBG) levels, increased fasting serum insulin (FINS) levels, and increased Insulin Sensitivity Index (ISI) in diabetic rats [40-41]. In addition, this plant modulates lipid and glucose metabolism and stimulates GLUT4 translocation through activation of PI3K and AMPK pathways, providing scientific support for its traditional use [42].

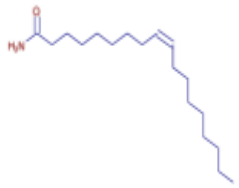
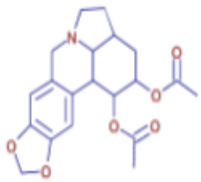
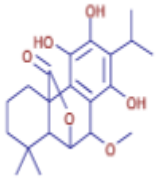
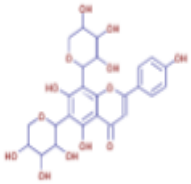
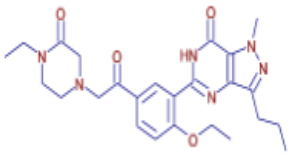
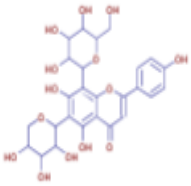
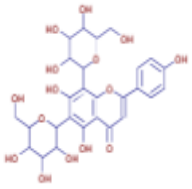
3.4. Chemical Profilling using UHPLC MS/MS-Q-Orbitrap

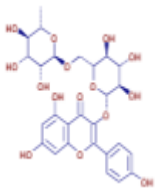
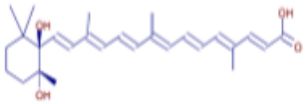
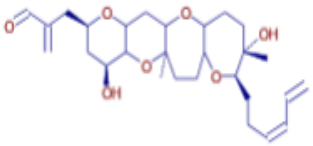
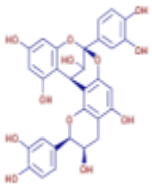
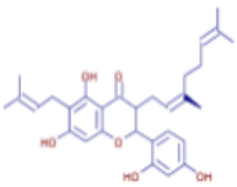
Results of metabolite profiling with HRMS UHPLC-Q-Orbitrap identified 28 compounds. Data analysis using Compound Discoverer software (Thermo Scientific), which is directly connected to the online database in the form of Chemspider and MZcloud. The predicted compound groups contained in the *Portulaca oleracea* L. herb extract are alkaloids, terpenoids, flavonoids, phe-nylpropanoids, polyketides, amino acids and their derivatives, unsatu-rated fatty acids, saturated fatty acids, esters, amines (primary,secondary,tertiary,andquaternaryaminesalts),amides, glycoside compounds, alcohols, phenolic compounds, aromatic ketones, carbox-flic acids, and others. The research results indicated antioxidant activity with an IC50 value of 40.41 micrograms per milliliter, as well as inhibitory activity against alpha-glucosidase with an IC50 value of 229.41 micrograms per milliliter. HRMS UHPLC-Q-Orbitrap profiling of the 28 compounds in purslane extract revealed the presence of various flavonoids, polyphenols, alkaloids, fatty acids, terpenoids, and organic acids, including compounds such as chromene-4-one, apigenin, nictoflorin, gallic acid, oleamide, 3,5-dioxooctanedioic acid, and 7-deoxyloganetin.

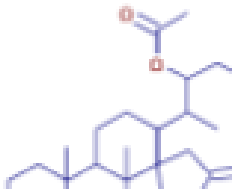
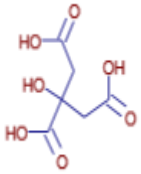
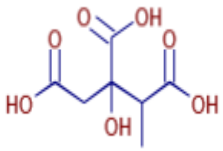
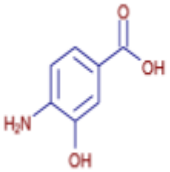
This is consistent with previous research, which reveals that flavonoid and polyphenol are major contributors to the antioxidant activity of Portulaca oleracea. Specific flavonoids such as cynaroside have been isolated and shown to have strong antioxidant activities [45]. These compounds are among the most abundant in purslane and are believed to contribute significantly to its antidiabetic properties. For instance, specific alkaloids have shown anti-inflammatory effects, which may indirectly support glucose metabolism by reducing systemic inflammation [44]. Compounds such as protocatechuic acid, ferulic acid, and gallic acid have been isolated from purslane and shown to possess antioxidant properties which can help mitigate oxidative stress associated with diabetes [45]. Purslane is rich in vitamins such as ascorbic acid (vitamin C) and tocopherols (vitamin E), which are well-known antioxidants. Additionally, it contains omega-3 and omega-6 fatty acids, which are known to improve insulin sensitivity and reduce inflammation [46-47] and contribute to its antioxidant capacity [48]. The plant also contains other bioactive compounds like saponins, tannins, and triterpenoids, which have been associated with antioxidant [49-50].

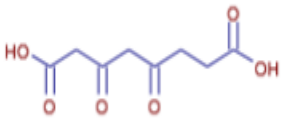
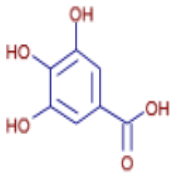
Table 3. Bioactive phytochemicals analyzed via UHPLC MS/MS-Q-Orbitrap in (*Portulaca oleracea* L.) herb extract

No	Name	Retention Time	Molecular Formula	Molecular Weight	Structure
1	7-deoxyloganetin	7.171	$C_{11}H_{16}O_4$	212.10443	
2	Fuberidazole	4.409	$C_{11}H_8N_2O$	184.0636	
3	Diphenol glucuronide	1.11	$C_{12}H_{14}O_8$	286.06831	
4	2-Hydroxy-1-(4-methoxyphenyl)-3-pentanone	8.165	$C_{12}H_{16}O_3$	208.10967	
5	Questiomycin A	4.409	$C_{12}H_8N_2O_2$	212.05835	
6	Apigenin	8.374	$C_{15}H_{10}O_5$	270.05281	
7	NP-001798	8.284	$C_{16}H_{17}NO_2$	255.12596	

8	Oleamide	14.716	$C_{18}H_{35}NO$	281.27138	
9	2,3,3a,4,5,7,12b,12c-Octahydro-1H-[1,3]dioxolo[4,5-j]pyrrolo[3,2,1-de]phenanthridine-1,2-diyl diacetate	7.619	$C_{20}H_{23}NO_6$	373.15209	
10	11,12,14-Trihydroxy-7-methoxy-6,20-epoxyabieta-8,11,13-trien-20-one	8.167	$C_{21}H_{28}O_6$	376.18801	
11	5,7-dihydroxy-2-(4-hydroxyphenyl)-6,8-bis(3,4,5-trihydroxyoxan-2-yl)-4H-chromen-4-one	5.563	$C_{25}H_{26}O_{13}$	534.13768	
12	Oxohongdenafil	14.537	$C_{25}H_{32}N_6O_4$	480.24883	
13	Corymboside	5.134	$C_{26}H_{28}O_{14}$	564.14824	
14	5,7-Dihydroxy-2-(4-hydroxyphenyl)-6,8-bis[3,4,5-trihydroxy-6-(hydroxymethyl)tetrahydro-2H-pyran-2-yl]-4H-chromen-4-one	4.677	$C_{27}H_{30}O_{15}$	594.15831	

15	NICTOFLORIN	5.942	$C_{27}H_{30}O_{15}$	594.15874	
16	Azafrin	12.052	$C_{27}H_{38}O_4$	426.27703	
17	9a,11b-Dimethyl-9-(2-methyl-1,3-dioxolan-2-yl)tetradecahydrospiro[cyclopenta[1,2]phenanthro[8a,9-b]oxirene-3,2′-[1,3]dioxolan]-11-yl acetate	12.887	$C_{27}H_{40}O_7$	476.27717	
18	2,4,6-Trihydroxy-5-{1-[4-hydroxy-6-(2-hydroxy-2-propanyl)-4,8a-dimethyldecahydro-1-naphthalenyl]-3-methylbutyl}isophthaldehyde	12.134	$C_{28}H_{42}O_7$	490.29292	
19	Procyanidin A2	13.165	$C_{30}H_{24}O_{12}$	576.12615	
20	2-(2,4-Dihydroxyphenyl)-3-[(2Z)-3,7-dimethyl-2,6-octadien-1-yl]-5,7-dihydroxy-6-(3-methyl-2-buten-1-yl)-2,3-dihydro-4H-chromen-4-one	11.526	$C_{30}H_{36}O_6$	492.25102	

21	3-(7′-Hydroxy-4b′,8′,8′,10a′-tetramethyl-5-oxotetradecahydro-2′H-spiro[furan-3,1′-phenanthren]-2′-yl)-1-(4-methyl-5-oxo-2,5-dihydro-2-furanyl)-2-butanyl acetate	13.318	$C_{32}H_{48}O_7$	544.33998	
22	1-O-(1Z-Tetradecenyl)-2-(9Z-octadecenoyl)-sn-glycerol	20.532	$C_{35}H_{66}O_4$	550.49504	
23	2,5-Furandicarboxylic acid	1.017	$C_6H_4O_5$	156.0056	
24	Citric acid	0.841	$C_6H_8O_7$	192.02664	
25	2-methylcitric acid	1.888	$C_7H_{10}O_7$	206.04242	
26	4-Amino-3-hydroxybenzoic acid	1.707	$C_7H_7NO_3$	153.04231	

27	3,5-Dioxooctanedioic acid	2.454	$C_8H_{10}O_6$	202.04745	
28	Gallic Acid	1.281	C7H6O5	170.0214	

4. Conclusion

The research showed that the substance possesses antioxidant capasity, with an IC50 value of 40.41 µg/mL, and also has inhibitory effects against α-glucosidase, with an IC50 value of 229.41 µg/mL. The results of UHPLC-Q-Orbitrap mass spectrometry analysis of the 28 compounds found in the purslane extract identified flavonoids, polyphenols, alkaloids, fatty acids, terpenoids, and organic acids, including chromen-4-one, apigenin, nictoflorin, gallic acid, oleamide, 3,5-dioxooctanedioic acid, and 7-deoxyloganetin that contribute to alpha-glucosidase inhibition and correlated with antioxidant capacity. These result highlight the potential of purslane herb particularly flavonoid and polifenol as a promising natural agent for controlling hyperglicemia in T2DM.

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