Supplementary Materials

The Potential of Edible and Medicinal Resources Polysaccharides for Prevention and Treatment of Neurodegenerative Diseases

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Table S1. Summary of the role of polysaccharides in the regulation of neurodegenerative diseases.

	Sources of polysaccharides	Characterization	Models	Doses and time of polysaccharides	Biological activity	References
1.	***Abelmoschus moschatus* polysaccharides (OP)**	Man, Rha, Glc, Gal, and Ara	1.0 mg/mL of 2 μL Aβ1–42 induced AD model mice,1 time	300, 600 mg/kg (OPL) for 8 weeks	↓Cognitive impairment ↑PI3K and AKT, pERK1/2 ↓GSK3β ↑PI3K/AKT and ERK pathways	[20]
2.	***Inonotus obliquus* polysaccharides (IOP)**	111.9 kDa, no nucleic acids or proteins	25mM L-Glu-induced HT22 cell for 24h APP/PS1 mice	Pre-treated with 5 or 10 μg/mL for 3 h 25 or 50 mg/kg for 8 weeks	↑Spatial learning and memory ↓Oxidative stress, apoptosis ↓Deposition of Aβ1–42 and P-Tau ↑Bcl-2, Nrf2, HO-1, SOD-1, GCLC ↓Bax, Keap1 ↑Nrf2 pathway	[22]
3.	***Ganoderma lucidum* polysaccharides (GLP)**	15.0 kDa	APP/PS1 transgenic mice 1 ng/mL EGF and 1 ng/mL bFGF induced neural progenitor cell for 24 h	30 and 200 mg/kg for 90 days After-treated with 300 mg/mL for 24h	↑Cognitive Function ↑NPC Proliferation ↑FGFR1, p-ERK, p-AKT ↑ERK and AKT pathway	[24]
4.	***Momordica Charantia* polysaccharides （MCP）**	85-100 kDa Ara, Xyl, Gal, and Rha (1.01 : 1.13 : 4.17 : 1.67)	C57B/6 male mice were intraperitoneally injected 25 mg/kg MPTP for 7 days 1mM MPP+ induced SK-N-SH cells for 24 hours	After-treated with 100 mg/kg were given for 7 days After-treated with 80 μg/mL for 24 hours	↑Cell viability ↓Dyskinesia ↓Inflammation, Oxidative Stress, and Apoptosis ↑DA, DOPAC, HVA, GSH, SOD, Bcl-2 ↓5-HT, 5-HIAA, TNF-α, IL-1β, MDA, Cytochrome C, Bax, cleaved Caspase-3 in the brain tissue ↑TH in the striatum ↓TLR4, MyD88, p-p65	[25]

				↓TLR4/MyD88/NF-κB pathway	
		HEK293 cells were transfected with EGFP-exon-1 htt-20Q and EGFP-exon-1 htt-160Q	After-treated with 9.6 μg/μL LBP for 24 h.	↑Life span, body weight, motor functions ↓mHtt aggregates, caspase-3 ↑p-AKT-Ser473	[26]
		HD-N171-82Q-81 (also known as B6C3-Tg (HD82Gln)81Dbo/J Tg) mice	40 mg/kg body weight per day for10 weeks	↑AKT pathway	
5. ***Lycium barbarum*** **polysaccharides (LBP)**		30 mg/kg/d MPTP induced male C57BL/6 mice for 5 days	After-treated with 100 and 200 mg/kg for 16 days	↑Spontaneity, coordination, learning and memory abilities ↓aggregation of α-syn ↓Dopaminergic Neurodegeneration, LC3I/II and Beclin ↑SOD2、CAT and GPX1 ↑p-AKT and mTOR ↑PTEN/AKT/mTOR pathway	[44]
	Man, Glc, Gal, Xyl and Ara (6.52: 78.12: 8.85: 1.81: 4.69.)	APP/PS1 transgenic mice	Oral administration of 50 mg/kg for 3 months	↑Cognitive functions ↑Neurogenesis ↓Synaptic dysfunction ↓Aβ levels and amyloid plaque burden	[104]
		HEK293/APPswe cells	300 μg/ml for 24 hours		
		HTM cells were exposed to 200 μM H2O2 for 24 h	Pre-treated with 100, 200,300, 400 and 500 μg/mL for 1 h	↓Oxidative damage, apoptosis ↑ miR-4295 ↓Cleaved-caspase-3/-9 and ROS ↑PI3K/AKT and ERK signaling pathways	[121]
		N2a cells 3.75μM TMT for 24h	Pre-treated with 300 μg/mL for 24 h	↓Apoptosis and oxidative stress	[122]

				↑Bcl-2, SOD, caspase-3, p-GSK-3β, p-Akt, Shh, Gli1, CyclinD1 ↓ROS, MDA ↑Shh and PI3K/Akt pathways ↓Apoptosis and oxidative stress	
	L-Rha, Glc, and erythritol	20 mM L-Glu-induced PC12 cells for 24 h	Pre-treated with 10 and 30 μg/ml alone for 3 h	↑MMP, Bcl-2, p-Akt, and p-ERKs ↓ ROS, Bax, caspase-3 ↑Akt and ERK pathway ↓Mitochondrial apoptotic pathway	[123]
		PC12 cells induced by 400 μM H2O2 for 24h	Co-treated with 125-500 μg/ml for 24 h	↓Oxidative stress and apoptosis ↓Caspase-3, Caspase -9, ROS, ↑Nrf2 and HO-1 mRNA and protein ↑Nrf2/HO-1 pathway	[133]
	45.0 kDa; Ara, Gal, Glc and Rha (47.8: 49.8: 1.4: 1.2)	HEK293-APPsw cells	0.6, 1.1, 2.2 μM for 24 h or for 72 h	↓Aβ42 production and aggregation	[134]
		75 μM 6-OHDA induced PC12 cells for 24 h	Pre-treated with 100, 300, 600 μg/mL LBP for 24 h	↓Apoptosis and oxidative stress ↓ROS, NO, 3-NT, intracellular free Ca^{2+}, NF-κB, nNOS, iNOS, caspase-3 ↓ROS-NO pathway	[135]
6.	***Codonopsis pilosula* polysaccharides (CPP)**	APP/PS1 mice	100 and 300 mg/kg for one month	↑Cognitive ability ↓$A\beta_{1-42}$ deposition	[40]
		N2a and HEK293 cells transfected with APP plasmid	200μg/ml for 24h	↑synaptic plasticity, synaptic proteins (PSD95, synaptotagmin) ↓BACE1	

			Injected 2 ml of 6.82×1012v.g./ml AAV2/hTau into the hippocampus of C57/BL6 mice	After-treated with 100, 300 mg/kg for 1 month.	↓Memory Deficits ↑PP2A Activity ↓Tau Phosphorylation ↑Synaptic Plasticity and Functions	[43]
			HEK293/tau cells	After-treated with 50, 100, 200 mg/ml for 48 h.	↑Synaptotagmin, synaptophysin	
		Man (1.76%), Glc (97.38%), and Ara (0.76%).	1 μM $A\beta_{1-40}$ induced PC12 cells for 24 h	Co-treated with 50 μg/ml for 24 h	↑Cellular Viability ↑ATP, MMP, NAD+、NAD+/NADH、SIRT3、SIRT1, PGC-1α ↓ROS ↑Cognitive ability ↓Inflammation	[136]
7.	***Hericium erinaceus* polysaccharides (PHEB)**	36.1 kDa D-Gal, D- Glc, D-Man and D-GlcA	APP/PS1 mice	25 and 100 mg/kg for six weeks after fed for 24 weeks	↓Aβ deposition and tau hyperphosphorylation ↓ChAT, Ach, MDA, ROS ↑AChE, SOD, CAT, GSH-Px ↑Nrf2, HO-1, GABBR1, PKA, GluT1, Neurogranin, p-Akt, p-mTOR ↓Keap1, CaMK IV, p-CaMK II, ERK 1/2, Ras, P-GluR2 ↑Akt/ mTOR and Nrf2 pathway	[41]
8.	***Schisandra chinensis* (Turcz.) Baill polysaccharides (SCP)**	Ara, Glc, Gal, Man, Ribose, Xyl, GlcA, Rha and Fucose	AD model induced by 10 μg of 2 μg/μL $A\beta_{25-35}$ injection in the rat hippocampal CA1 region, 1 time	After-treated with 38.15 mg kg 1 day for 56 consecutive days	↑Spatial learning and memory ability ↓AchE, GSK-3β, NOS, Glu, Asp ↓$A\beta_{25-35}$ and p-Tau aggregations ↑SOD, 5-HT, NE, DA, Ach, Tau, GABA, Gly	[42]

		Man, Rha, GlcA, Glc, Gal, and Ara	Male KM mice were intracerebroventricular injected with 3μL Aβ1–42 peptide into the left lateral ventricle, 1 time	After-treated with 260 mg/kg for 28 consecutive days (i.g.).	↑Learning memory, cognitive capacity ↓Inflammation, activation of astrocytes and microglia ↓Aβ deposition ↓NF-κB in nuclear, p-p-38, p-JNK, p-ERK, IL-1β,1L-6, TNF- α ↑NF-κB and IκB-α in cytosolic ↓NF-κB/MAPK pathway	[79]
			All rats were injected with 5μL of 4 μg/μL Aβ25–35 into bilateral CA1 subregion,1 time	After-treated with 50 mg/kg for 4 weeks	↑Spatial learning and memory ↓Inflammatory, apoptosis ↑Ach, chAT, SOD, CAT, BDNF, TrkB, p-Akt, p-CREB ↓MDA, AchE, IL-1β, IL-6, TNF-α ↑BDNF/TrkB/CREB pathway.	[45]
9.	***Angelica sinensis* polysaccharides (ASP)**		Male Nestin-GFP transgenic mice were subcutaneously injected with 200 mg/kg D-Gal for 42 days	140mg/kg ASP, ip, for 27days since the 16th day of D-Gal induction model	↑Cognitive ability ↓Oxidative stress, inflammatory ↑Na^+-K^+ - ATP, SOD, T-AOC ↓MDA, IL-1β, IL-6, TNF-α, ROS, p53 mRNA, p21 mRNA ↓P53/p21pathway	[127]
			NSCs Induced by 20mg/mL D-gal for 48h	After-treated with 100 μg/ml for 24h		
10.	***Astragalus membranaceus* polysaccharides (APS)**	19.5% Ara, 6.4% Rha, 15.6%Gal, 29.5% GalA and 29.0%Glc.	*C. elegans* strain AM141	0.25, 1.0, 2.5, 5mg/ml for 24, 48, 72, 96 h	↓polyQ aggregates	[46]
			C. elegans strain HA759	0.25, 1.0, 2.5mg/ml for 3 days at 15°C	↓Neurotoxicity	
			C. elegans strain N2, AM141, HA759	1.0, 2.5mg/ml until death at 15°C	↑Lifespan	

	C. elegans strain N2, AM141, HA759	1 mg/ml for 3 days	↑DAF-16/FOXO ↓Gene scl-20	
	BV2 microglial cells induced by 50 ng/ml LPS for 24 h	Pre-treated with 0, 50, 100, or 200 μg/ml for 1 h	↓Inflammation ↓iNOS mRNA, COX-2 mRNA, TNF-α mRNA, IL-1β mRNA, TNF-α, IL-1β, NO, PGE2 ↓NF-κB and PKB pathway ↑Autophagy	[83]
	100 μM 6-OHDA in PC12 cells for further 24 h	Co-treated with 0,50, 100 and 200 μM for 24 h	↑LC3-I→LC3-II ↓p-mTOR and p-Akt mRNA and protein ↑PTEN mRNA and protein ↓PI3K/AKT/mTOR pathway ↓Oxidative stress and apoptosis	[100]
	APP/PS1 mice	200 mg/kg b.w./d, for 2 months	↓Deposition of Aβ40 and Aβ42 ↑Nrf2 in the nucleus, SOD, GSH-Px ↓Nrf2 in the cytoplasm, Keap1, MDA ↑Nrf2 pathway	[117]
5.14 kDa; Myo-inositol: fructose: sorbitol: Glc (1:1.4:2.1:13.7:91.5)	APP/PS1 mice	500 mg/kg twice per day for 7 weeks	↑Cognitive ability ↓Neuroinflammation ↓Activation of Astrocytes and Microglia	[137]
19.2% Ara, 6.9% Rha, 16.0% Gal, 28.8% Glc, and 29.1% GalA.	50mM 6-OHDA induced transgenic *C. elegans* strain BZ555 for 1 h at 20 °C.	0.5, 1, 2,4mg/mL for 72h	↓Food-Sensing deficit, degeneration of dopaminergic neurons	[138]
		2.0mg/mL until death	↑Lifespan	

			2.0mg/mL for 72h	↓Oxidative stress ↓ROS, MDA, Gene egl-1 ↑SOD, GPx, AChE	
11.	***Trametes versicolor* Polysaccharides (PSK)**		APP/PS1 mice	2 mg/mouse, 3 times/week for 6 months (i.p.)	↓Cognitive deficits ↓Activation of astrocytes and microglia ↓Aβ40, total Aβ, Aβ42 in brain, serum Aβ42 ↓pro-inflammatory cytokines TNF-α and IL-6 in brain homogenates, caspase-3 ↓Tau Phosphorylation in the hippocampus	[54]
12.	***Fomes officinalis* Ames polysaccharides (FOAP)**	Ara, Xyl, Man, Glc, and Gal	40μM Aβ25–35 induced PC12 cells for 48 h	After-treated with 50, 100 and 200 lg/mL for 2 h	↓Apoptosis, oxidative stress ↑Cell viability ↓LDH, ROS, MDA ↑Bcl-2/Bax, SOD, MMP, ATP	[67]
13.	***Epimedium brevicornum* polysaccharides (EbPS-A1)**	56.7% GalA, 19.4%Gal and 16.1%Rha but also 5.9%Ara and 2.0% GlcA	*C. elegans* HA759	0.5, 1, 2, 4 mg/mL for 3 days at 20°C. 2 mg/mL at 20°C for 3 days	↓Chemosensory dysfunction ↓Free radicals, ROS, MDA ↑SOD	[68]
14.	***Saccharina japonica* sulfated hetero-polysaccharides (UF)**	Fucose: Uronic Acid: Sulfate (19.12:14.25:21.2)	100 μM H2O2-induced SH-SY5Y for 24 h.	Co-treated with 100, 500, 800 μg/mL for 24 h	↓Apoptotic ↑p-PI3K, p-Akt, p-NGF ↓Bcl-2, Bad/bax, caspase-3, caspase-8, caspase-9, GSK3β, Cytc, p53 ↑PI3K/Akt Pathway	[53]

			Subcutaneous injection of 1.5 mg/kg/d rotenone induced Male Sprague–Dawley rats 5 times a week for 4 weeks	35, 70, 140 mg/kg/d started 10 days before rotenone induction, for 38 days	↓Behavioral deficits ↓Oxidative stress ↑TH-positive neurons and striatal TH-positive fibers, mitochondrial respiratory capacity ↑DA, DOPAC, PGC-1α, NRF2 ↓MDA, 3-NT, 8-OHdG ↑Nrf2 pathway ↓Inflammation	[69]
15.	***Laminaria japonica* polysaccharides (Fucoidan)**	Fucose: Gal (1.0:0.24)	Microglial cells induced by 0.01 μg/ml LPS for 24h	Pre-treated with 31.25, 62.5 and 125μg/ mL for 10 min	↓NO production, iNOS expression, p-p38 and p-ERK ↓p38 and ERK pathway	[112]
			C. elegans GMC101	20, 100, 500 and 2500 ng/ml for 31 h from 16 °C to 25 °C	↓Paralysis rate ↓deposition of Aβ protein ↓ROS ↑hsp16.2 expression	[139]
16.	**Fucoidan from *Fucus vesiculosus* (FVF)**	Fucans, Gal,Xyl.	20 mg/kg MPTP induced male C57BL/6 mice	10 and 40 mg/kg for 8days starting from one day before MPTP injection	↓Motor deficits ↓Mitochondrial dysfunction ↓Neuronal apoptosis ↓Dopaminergic neuron ↑ATP5F1a protein	[140]
17.	***Korean red ginseng* polysaccharides (NFP)**	GalA, Gal, and Ara (139.6:74.7: 63.4)	5XFAD mice	200 mg/kg for 3 weeks	↑Cognitive function ↓Inflammation, apoptosis ↓Aβ deposits ↓Mitochondrial dysfunction ↑Neurogenesis	[80]
18.	***Chlorella pyrenoidosa* polysaccharides**	Glc (69.14%), Rha (15.36%), Gal (14.29%),	Male C57BL/6 mice with 15 mg/kg MPTP four times at 2h interval (i.p.).	Oral administration 100,200 mg/kg/d was started 11 days before modeling, for 19 days	↓Bradykinesia ↓striatal depletion of DA, DOPAC and HVA ↑TH gene and nigral TH protein	[81]

	(CPS)	Man (1.16%) and Xyl (0.06%).			↓striatal Emr1, TNF-α, IL-1β and IL-6 in serum. ↑serum DAO and small intestinal secretory immunoglobulin A S-IgA	
			Aβ fibrils induced N2a cells for 24 h	Co-treated with 1 mg/mL BSP for 24 h	↓Learning memory ↑Cell Viability	
19.	***Bletilla striata* polysaccharides (BSP)**		10μM Aβ induced BV-2 cells	Co-treated with 1 mg/mL BSP for 24 h	↓Oxidative stress, Inflammation ↓Aβ Fibril Formation, Morphological damage in the hippocampus and cortex	[82]
			100 mg/kg AlCl3 induced SD rats three times every week, for eight weeks	Co-treated with 10 mg/kg/day for eight weeks	↓ROS, TNF-α, IL-6, and IL-10 ↓BACE1 ↑Spontaneity, coordination, learning and memory abilities	
			5 μl of 2 μg/μl 6-OHDA solution was injected unilaterally into the median forebrain bundle at a time	After-treated with 10, 50, 100 mg/kg for 14 days	↓Inflammation ↓NLRP3, IL-1β, Caspase 1, and proCaspase 1 ↓NLRP3 pathway	[84]
20.	***Antrodia camphorata* polysaccharides (ACP)**		6-OHDA induced MES23.5 for 24 h	Pre-treated with 10, 20, 50mM for 3h		
			5 μl of 2 μg/μl 6-OHDA solution was injected unilaterally into the median forebrain bundle at a time	10, 50, and 100 mg/kg for 7 days.	↓NLRP3, ASC, caspase-1, IL-1β, IL-18, ROS ↓ROS-NLRP3 pathway	[85]
21.	***Sparassis crispa* polysaccharides (SCP-1)**	Galactoglucan, main chain contains (1 → 6)-β-D-Glcp,	Oral with AlCl3 (20/kg/d) and subcutaneously injected with D-Gal (120 mg/kg/d) for eight weeks	25 mg/kg/d and 100 mg/kg/d once per day from the fifth week for four weeks	↓learning deficits and defective spatial recognition ↓Amyloidogenesis ↑Neurotransmitter levels (γ-aminobutyric acid, glutamate, and acetylcholine)	[86]

		(1 → 3)-β-D-Glcp, (1 → 6)-α-D-Galp			↓Inflammatory cytokines ↑Reshaped the gut microbiota ↑Intestinal barrier function, SCFAs ↓TLR4 and NF-κB ↓Apoptosis and oxidative stress	
22.	***Sparassis crispa* polysaccharides (SCWEA)**	75kDa; Rha, Man, and Gal (Gal) 10:2:1	25 mM L-Glu induced PC12 cell for 24 h	Pre-treated 4 μg/mL for 3 h	↓Ca2+, ROS, ↑MMP, Bcl-2, Bcl-xL, p-AKT, p-GSK-3 ↑AKT pathway. ↓Mitochondrial pathway	[109]
		18.796 kDa	5 × FAD mice	30 mg/kg per day at 3 months	↑Behaviors related to memory and cognition ↓Synaptic loss ↓Microglial phagocytosis of Aβ plaques, Aβ1–40 and Aβ1–42 ↑Reconstructed the gut microbiota composition ↓Gut barrier integrity damage, inflammatory responses, and the intestinal Aβ deposition	[87]
23.	***Polygonatum sibiricum* polysaccharides (PSP)**		30 mg/kg MPTP (i.p.) induced C57BL/6J male mice for five days.	10, 30 mg/kg PSP orally started 30 days before MPTP induction, for 45 days	↑Motor abilities ↓Apoptosis, Oxidative Stress，Dopaminergic neurodegeneration ↓ROS	[118]
			500 μM MPP+ induced N2a cells	Pre-treated with1, 10, 100, 200, 400 μg/mL for 24 h	↑GSH/GSSG ↑p-Akt, p-mTOR, Nrf2, NQO1, HO-1, Gclc, Gclm ↑Akt/mTOR and Nrf2 Pathways	
		76 kDa, Gal:Man (12.1:5.4)	20μM $A\beta_{25-35}$-induced neurotoxicity in PC12 cells	Pre-treated with 10, 20, 50, 100 and 200 μg/ml for 24 h	↓Bax/Bcl-2 ratio, caspase-3 ↑p-Akt ↑PI3K/AKT pathways	[124]

24. ***Spirulina platensis*** **polysaccharides (PSP1)**		Male C57BL/6J mice (i.p.) with 15 mg/kg MPTP 4 times, at 6-hour intervals	Pre-treated with 200, 400, or 800 mg/kg for 10 days	↓Oxidative stress ↑TH and DAT protein and mRNA in the SN pars compacta ↑SOD, and GSH-Px	[102]
25. **Edible** ***Dictyophora echinovolvata*** **polysaccharides (DEVP)**		PC12 cells induced by 750mM H_2O_2 for 24 h	Pre-treated with 10, 30, 100, 250, 500 mM for 2 h	↓Apoptosis and oxidative stress ↑Bax, caspases 3, cytochrome c ↓ Bcl-2, ROS ↓Mitochondrial apoptotic pathway	[107]
26. ***Tremella fuciformis*** **polysaccharides （TL04）**	Rha, Man and Glc, 1:5.04:1.87	20 mM L-Glu induced PC12 cells for 12-24 h	Pre-treated 5 and 20 μg TL04 for 3h	↓Apoptosis and oxidative stress ↓ROS, caspase 3, Bax, Cyto C, caspase 8, caspase 9 and caspase 3, LDH ↑Bcl-2 ↓Mitochondrial pathway ↑Horizontal movements, learning and memory, cognitive abilities	[108]
27. ***Armillaria mellea*** **polysaccharides (AMPS)**		HT22 cells incubated with 25mM of L-Glu for another 24 h	Pretreated with AMPSc at doses of 40 and 80 μg/mL for 3 h	↓Apoptosis and oxidative stress ↓$A\beta_{1\text{-}40}$ and p-Tau aggregations ↓MMP, ROS, AchE, ROS ↑Ach, ChAT, SOD, GSH-Px, 4-NHE	[110]
28. ***Morchella importuna*** **polysaccharides (MIP)**		PC12 cells induced by 0.8mM H_2O_2 for 6h	Pre-treated with 12.5, 50, 100, 200, 400, 800μg/ml for half an hour	↓Oxidative stress and apoptosis ↑SOD, CAT, GSHPx ↓ Bcl-2, Bax, caspase-3 ↑ERK pathway ↓NF-κB pathway and the p38-JNK pathway	[113]
29. ***Acorus tatarinowii*** **polysaccharides (ATP)**		1 μg/mL LPS induced proinflammatory BV2 cells for 24 h	Pretreated with 2.5, 5.0, 10 μM for 2 h.	↓NF-κB, TLR4, MyD88, p-PI3K, p-Akt, ↓ROS, MMP, TNF-α, IL-1β, IL-6, COX2, and iNOS	[115]

30.	***Vitis vinifera L.* polysaccharides (VTP)**		10mL of 2mg/mL Aβ25–35 slowly injected into the hippocampal CA1 region (5ml per side) of Sprague Dawley rats,1 time	50,150, 300 mg/kg VTP for 14 days.	↓TLR4-mediated MyD88/NF-κB and PI3K/Akt signaling pathways ↑Learning and memory abilities ↓Apoptosis, Inflammation ↓TNF-α, IL-6 and IL-1β in serum, NF-κBp65 and IkB-a mRNA level ↓p-NF-κB-p65, p-IkB-a ↓NF-κB pathway	[141]
			150mg/kg/d D-Gal induced C57BL/6 mice (i.p.) for 6weeks	After-treated with 1, 10, 20, 50, 100 and 150mg/kg/d for 6weeks	
31.	***Taxus chinensis var. mairei Cheng et L.K.Fu (Taxaceae)* polysaccharides (PTM)**		BV2 induced by 1M D-gal for 48 h.	Pre-treated with 500 μg/mL for 48 h.	↑Spatial learning capability, cognitive function ↓Oxidative stress ↓Deposition of Aβ1–42 ↓MDA, ROS, SOD, caspase-3, Bax/Bcl-2 ↑ Nrf2 pathway	[142]
			Balb/c male mice subcutaneously injected with 120 mg/kg of D-gal and orally treated with 20 mg/kgof $AlCl_3$ once a day for 8 weeks.	Starting from the fifth week, 25 and 100 mg/kg/day for four weeks.	
32.	***Pleurotus ostreatus* polysaccharides (POP)**		Male Wistar rats induced by Al (200 mg/kg, i.g.) and D-gal (60 mg/kg, i.p.) for 60 days	On the 30th day of modeling, POP (400 mg/kg) i.g. for 30 days	↑Learning and memory performance ↓Oxidative stress ↓AchE, APP, Aβ, BACE-1, p-tau, and GSK3β ↑SOD, GSH-Px, CAT, PP2A	[143]
33.	***Alpinia oxyphylla* polysaccharides (AOP)**	76.66 kDa; Man, Rha, GlcA,	1 mg/kg/d scopolamine induced male Kungming (KM) mice for 23 days	Co-treated with 70 500 mg/kg/d for 23 days	↑Memory abilities ↓Inflammation ↓NO, IL-1β, PGE-2, and TNF-α in serum	[144]

		Glc, Gal, Xyl, and Ara (2.60: 1.95:6.73: 1.81: 21.08: 40.59: 43.83)	1 μg/mL LPS of BV2 cells for 24 h	0.325, 0.65, 1.30, 2.60 μM for 24 h		
34.	***Gynostemma pentaphyllum* polysaccharides (GP)**		1 mM MPP+ induced PC12 cells for 24 h	Pre-incubated 50μg/ml for 2 h	↓Apoptosis ↓Bax/Bcl-2 ratio, cytc c, caspase-3/9, cleavage of PARP ↓Mitochondrial apoptotic pathway	[145]
			70 mM paraquat induced wildtype *C. elegans*	0.5, 1, 2 mg/mL until death	↑Survival rate	
35.	***Dictyophora indusiata* polysaccharides (DiP)**	86.8%Man, 4.5% Fucose, 3.9% Glc, 1.6% Gal, 1.2% Rha, 1.1% GlcA and 0.9% Xyl.	10 mM paraquat induced *C. elegans* CL2166 for 24 h	1.0 mg/mL for 48 h	↓Oxidative stress ↓ ROS, MDA, MMP ↑SOD, ATP	[146]
			C. elegans LG345	1.0 mg/mL at 20°C from L1 to L2 larvae	↑DAF-16/FOXO	
			C. elegans GR1352	1.0 mg/mL at 20°C from L1 to L3 larvae		
			C. elegans HA759	1.0 mg/ml for 72 h	↓Behavioral dysfunction (avoidance assay)	

Man,Mannose; Rha, Rhamnose; Glc, Glucose; Ara, Arabinose; Xyl, Xylose; GlcA, Glucuronic acid; GalA, Galacturonic acid; Gal, Galactose; i.g. intragastrically; i.p, intraperitoneal injection; EGF, epidermal growth factor; bFGF, basic FGF.↑ indicates increase/promotion/activation while ↓ indicates inhibition/reduction/inactivation.

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