

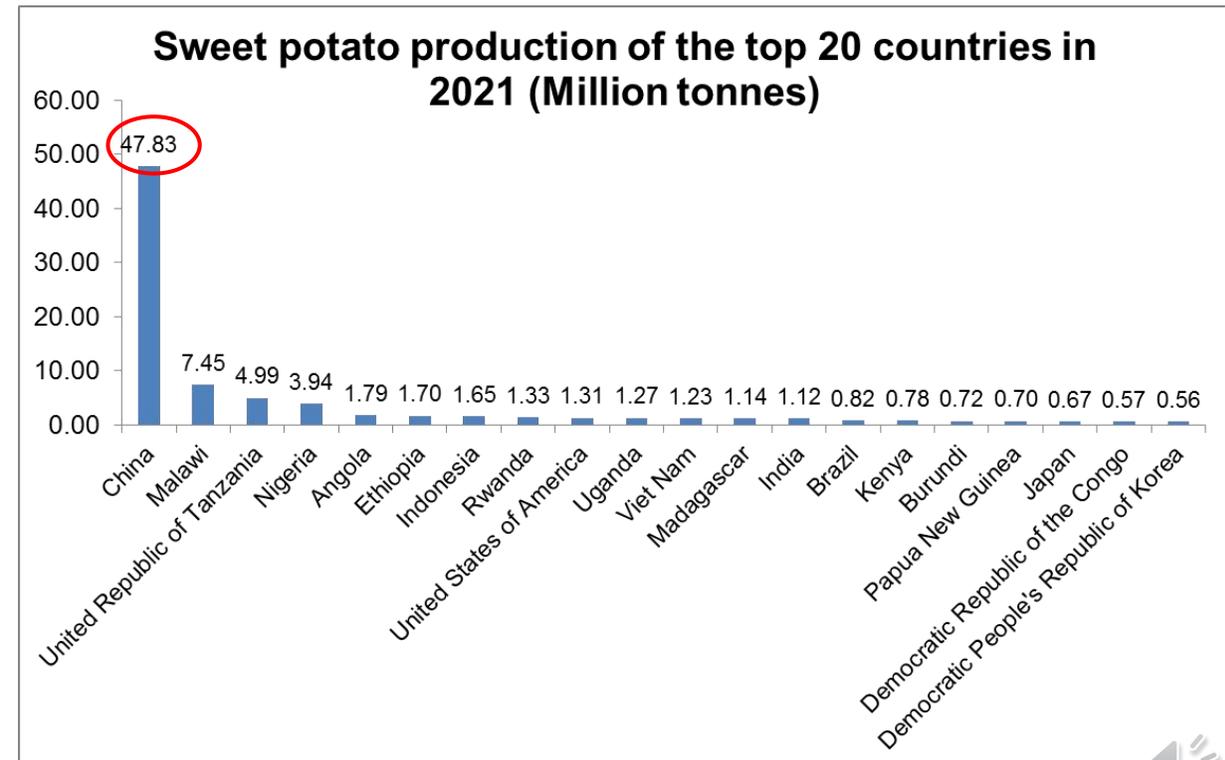
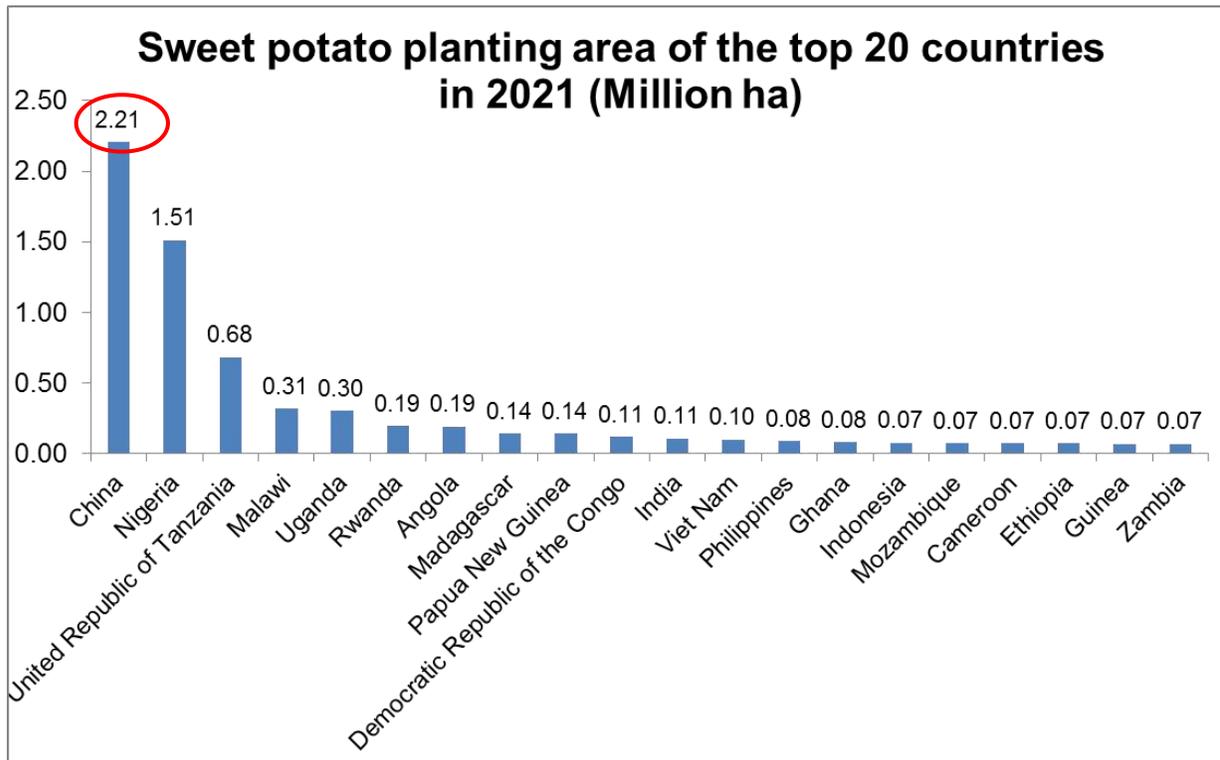
Key Technologies of Sweet Potato Processing and Comprehensive Utilization of its by-Products

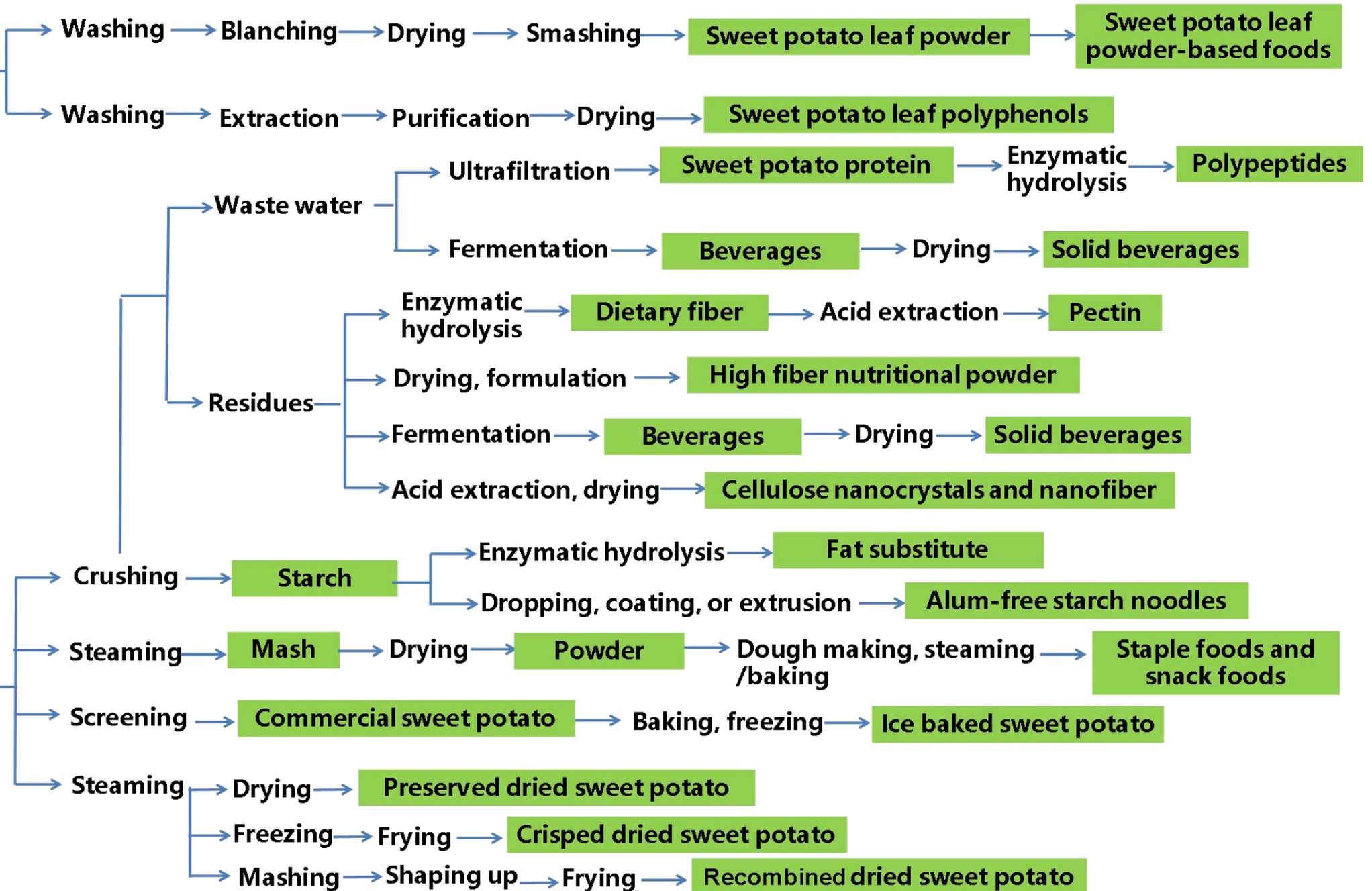
Prof. Dr. Tai-hua Mu

**Sweet Potato and Potato Processing Innovation Team,
Institute of Food Science and Technology, Chinese Academy of Agricultural
Sciences (IFST,CAAS)**

Planting area and production of sweet potato

- According to the latest statistical data of FAO, the total planting area and production of sweet potato in 2021 all over the world are **7.41 million ha** and **89.08 million tonnes**, respectively.
- China is the largest producer of sweet potato, with the planting area and production in 2021 is **2.21 million ha** and **47.83 million tonnes**, respectively.





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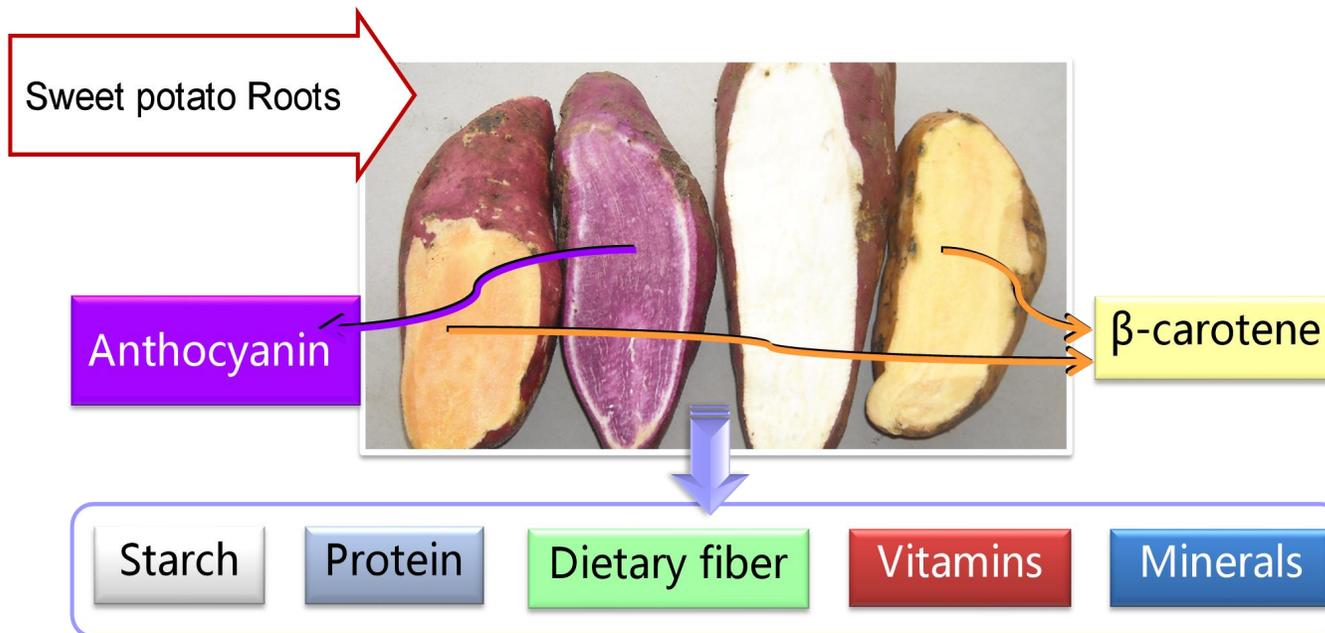
Comprehensive Utilization of Sweet
Potato by-products



01

Nutritional Components in Sweet Potato and Their Functions





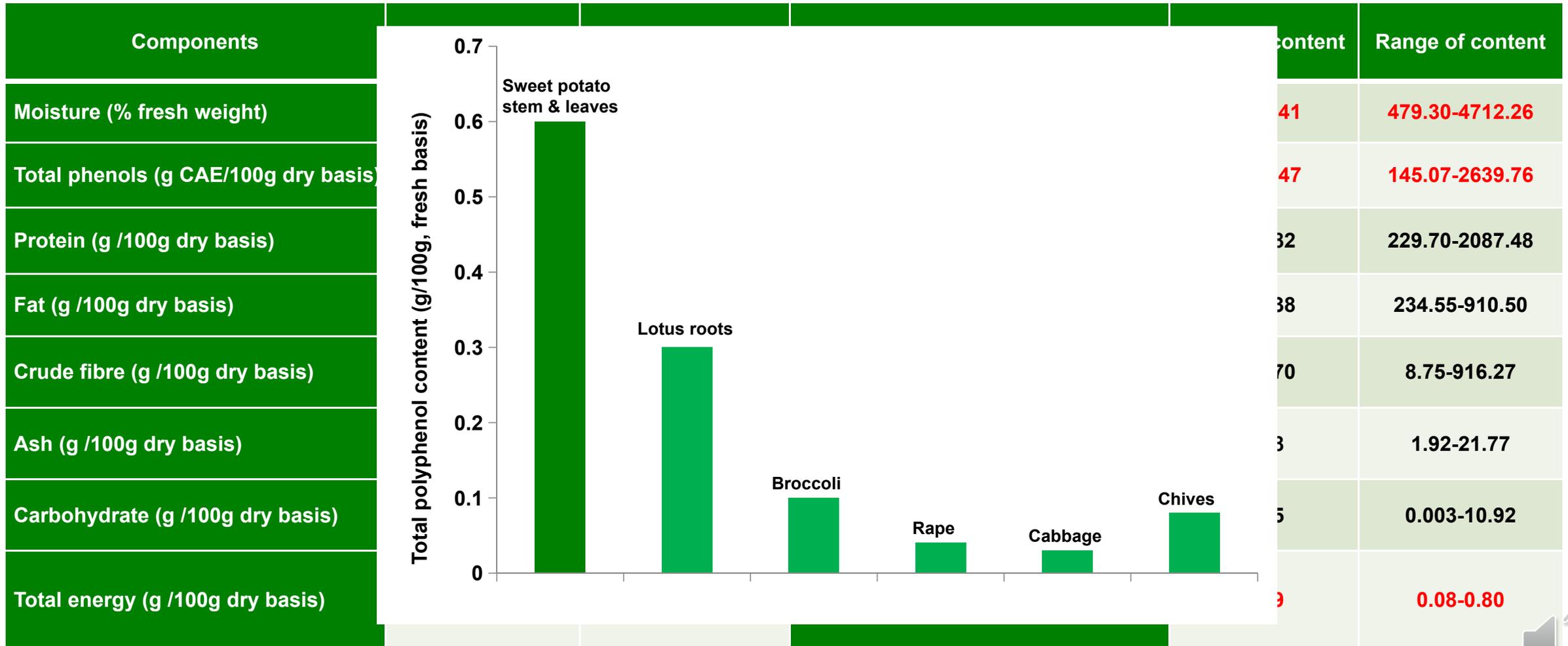
Nutritional composition in sweet potato roots (dry matter)

Components	Content
Starch (g/100g)	66.90±4.55
Fat (g/100g)	0.88±0.04
Ash (g/100g)	1.82±0.63
Protein (g/100g)	5.57±1.51
Dietary fiber (g/100g)	7.05±1.04
Insoluble dietary fiber(g/100g)	4.18±0.82
Soluble dietary fiber (g/100g)	2.87±0.69
β-carotene (mg/100g)	1.19±1.16
Reducing sugars (g/100g)	4.12±0.05
V_{B1} (mg/100g)	0.31±0.05
V_{B2} (mg/100g)	1.20±1.11
V_{B3} (mg/100g)	2.07±0.58
V_C (mg/100g)	80.99±31.40
Na (mg/100g)	229.87±113.15
Mg (mg/100g)	94.61±20.53
K (mg/100g)	1110.17±230.31
P (mg/100g)	135.54±33.06
Ca (mg/100g)	101.72±23.45
Fe (μg/100g)	1271.63±324.34
Zn (μg/100g)	429.33±85.12
Se (μg/100g)	4.21±0.86

*Average data of 58 sweet potato cultivars



The basic nutritional components of sweet potato leaves (40 cultivars)



Sweet Potato Protein

Amino acid compositions of four proteins from different sources (mg/g protein)

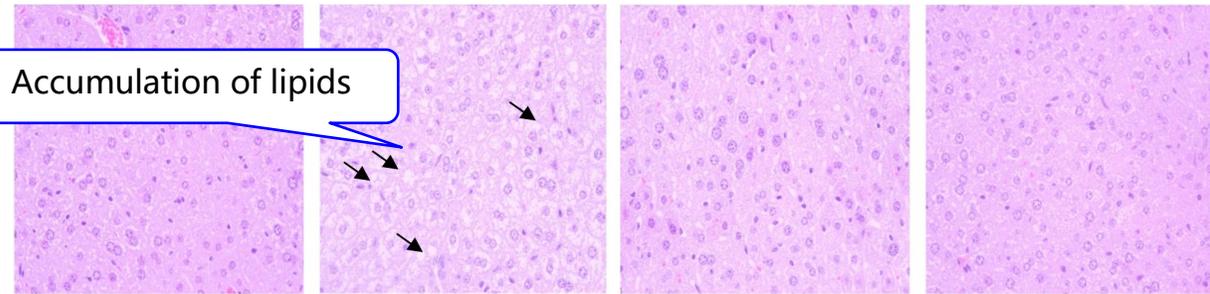
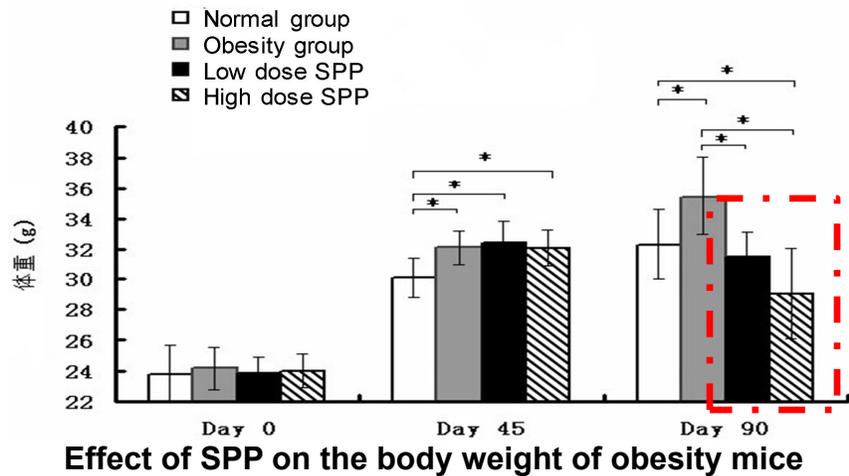
EAA	SPP	PP	SPI	WPI	NEAA	SPP	PP	SPI	WPI
Ile	48.52	41.31	44.24	54.44	Asp	162.65	93.41	114.34	113.01
Met	21.27	25.39	11.83	21.86	Ser	64.25	44.59	53.50	39.37
Val	72.79	48.30	47.46	51.46	Glu	87.46	105.60	196.66	171.80
Leu	68.59	82.01	80.00	128.82	Pro	30.25	44.11	30.10	30.03
Trp	16.77		17.75	14.75	Gly	45.38	37.01	40.64	16.77
Phe	71.29	51.29	52.99	35.02	Ala	46.88	45.69	40.13	50.62
Thr	61.26	47.70	38.07	48.07	Cys	14.68	27.91	8.87	26.74
Lys	41.34	63.61	60.19	103.25	Tyr	52.72	39.79	37.56	36.08
total	401.83	359.61	352.53	457.67	His	34.45	18.00	42.96	31.62
					Arg	59.46	41.29	82.70	26.32
					total	598.18	497.40	647.46	542.36
EAA/(EAA+NEAA)	40.18%	41.96%	35.25%	45.77%					
EAA/NEAA	67.18%	72.30%	54.45%	84.39%					

FAO/WHO (1991) Standard: $EAA/(EAA+NEAA) > 40\%$; $EAA/NEAA > 60\%$.

Note: EAA, essential amino acid; NEAA, non-essential amino acid; SPP, sweet potato protein; PP, potato protein; SPI, soybean protein isolate; WPI, whey protein isolate.

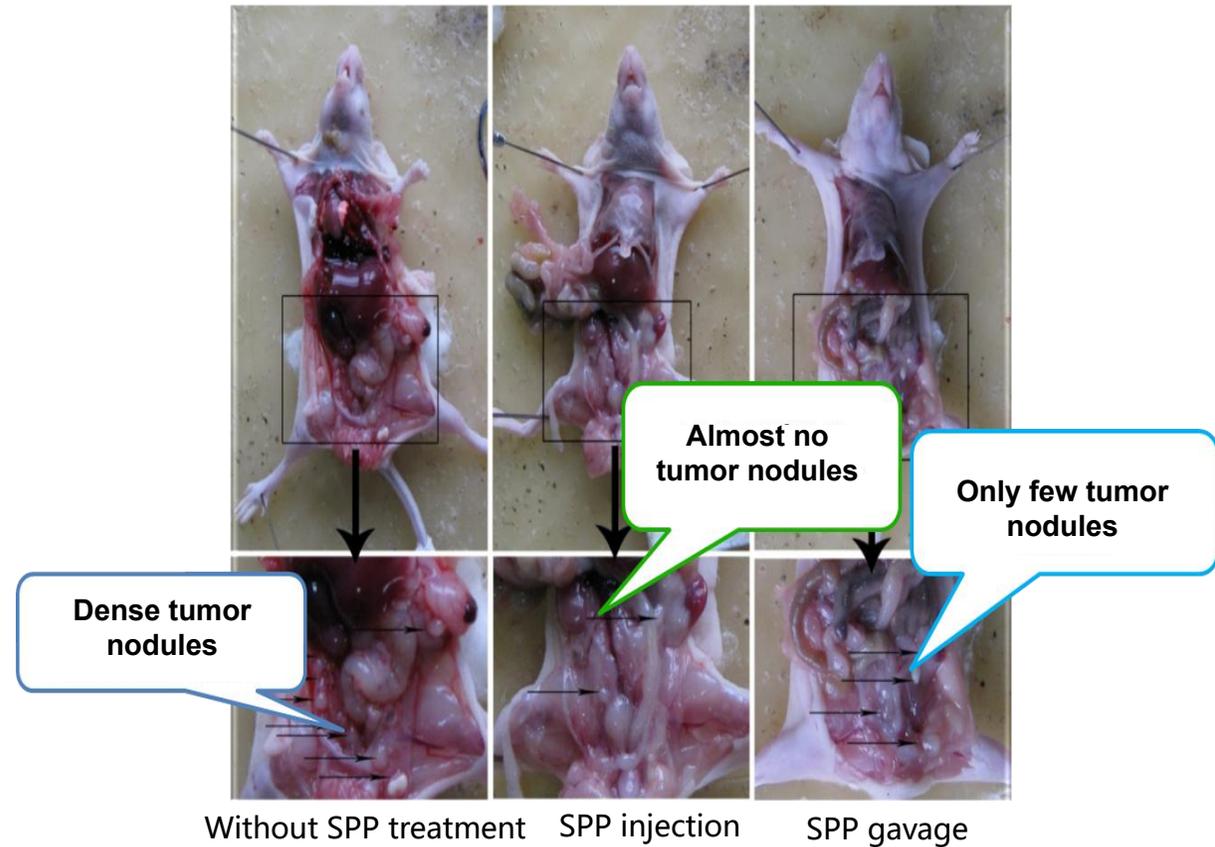


Animal experiments have confirmed that sweet potato protein has potential **anti-obesity** and **anti-tumor** effects.



Normal group Obesity group Low dose SPP High dose SPP

Effects of SPP on hepatocyte morphology in obese mice

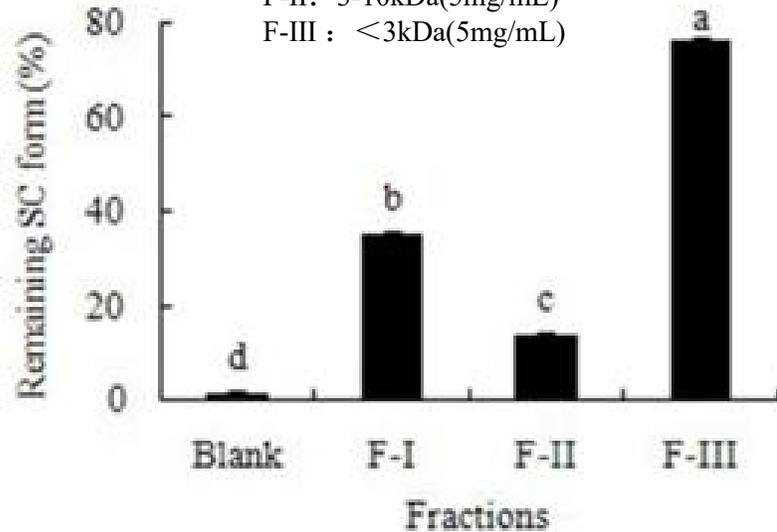


Effects of different administration on intraperitoneal neoplasm nodules in mice with colon cancer

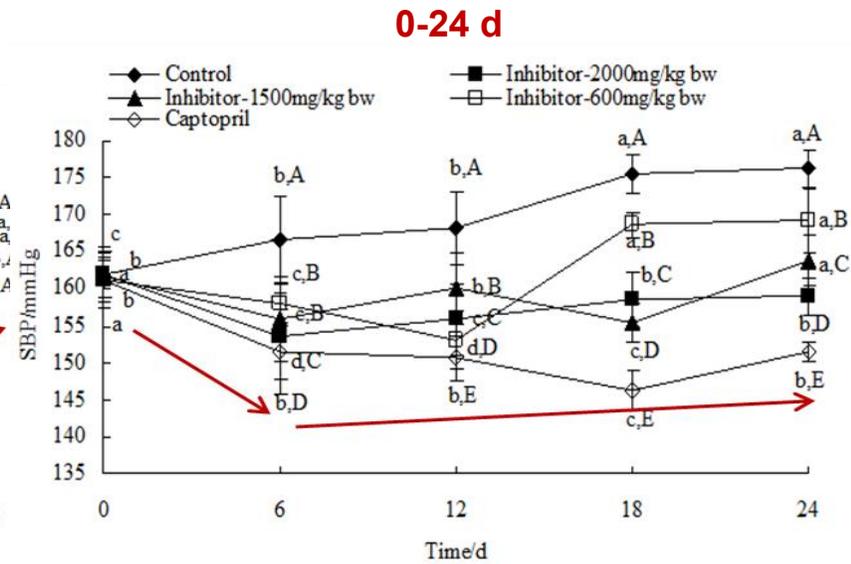
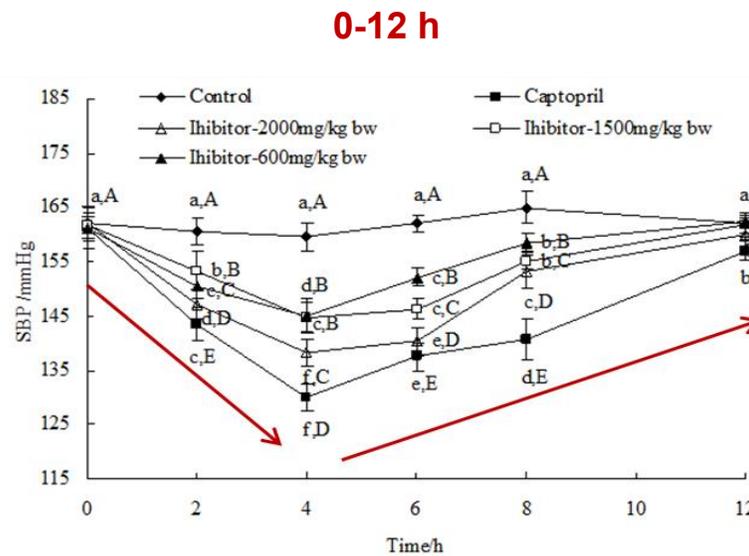
Sweet Potato Peptides

Sweet potato protein can be further enzymatically hydrolyzed to prepare peptides with potential **antioxidant** and **hypotensive** effects.

Blank: Water
 F-I: >10kDa(5mg/mL)
 F-II: 3-10kDa(5mg/mL)
 F-III: <3kDa(5mg/mL)



Effects of sweet potato peptides with different molecular weight on ·OH scavenging activity



Effects of sweet potato peptides on systolic blood pressure (SBP) of spontaneously hypertensive rats during 0-12 h and 0-24 d



Sweet Potato Dietary Fiber

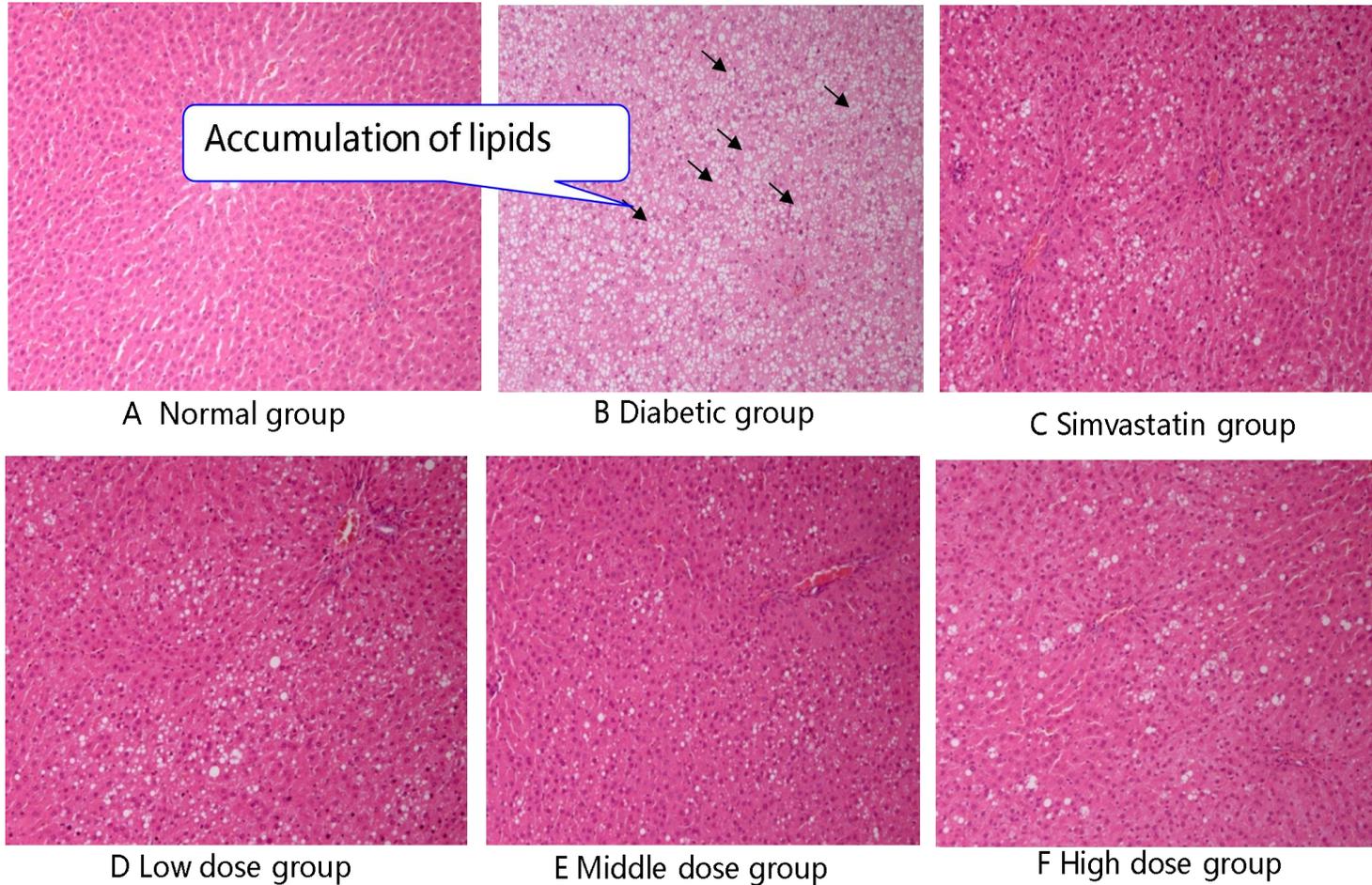
Sweet potato dietary fiber can **reduce the content of blood glucose (Glu), triglyceride (TG) and cholesterol (TC)** in diabetic rats, and **increase the content of high density lipoprotein cholesterol (HDL)**. The effect of high dose group is the best.

Effects of different doses of sweet potato dietary fiber on blood glucose and lipids in diabetic rats

Blood Index	A Normal group	B Diabetic group	B Low dose group	C Middle dose group	D High dose group	E Simvastatin group
Glu(mmol/L)	9.23±0.32 ^d	10.83±1.39 ^a	10.44±1.24 ^{ab}	10.20±1.92 ^b	9.76±0.68^c	9.93±0.46 ^{bc}
TG(mg/mL)	53.53±1.07 ^d	88.74±9.36 ^a	84.22±2.48 ^a	70.06±6.40 ^b	60.36±4.22^c	60.69±3.68 ^c
TC(mg/mL)	74.08±1.42 ^d	107.88±6.74 ^a	102.67±9.27 ^a	92.09±6.09 ^b	86.09±8.39^c	90.38±6.28 ^b
HDL(mg/mL)	55.62±1.06 ^a	45.34±3.26 ^d	46.86±4.97 ^e	47.29±3.14 ^e	48.17±2.98^c	52.97±3.45 ^b

Note: Glu, blood glucose; TG, triglyceride; TC, cholesterol; HDL, high density lipoprotein cholesterol.





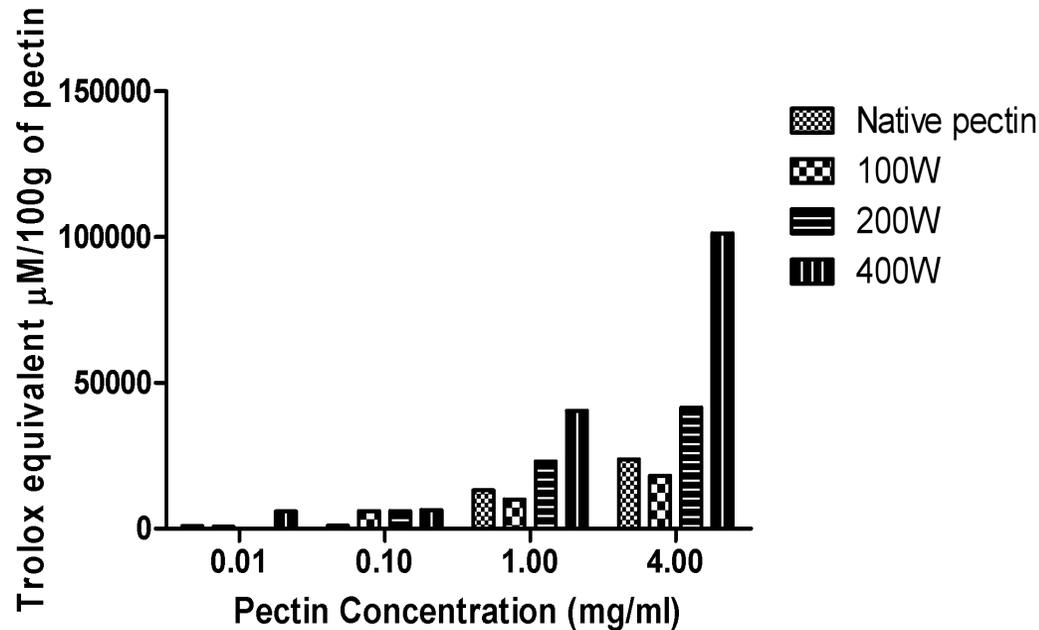
Sweet potato dietary fiber can significantly reduce the accumulation of fat in the liver of diabetic rats, thereby **inhibiting the formation of fatty liver.**

Effects of different doses of sweet potato dietary fiber on the liver in diabetic rats

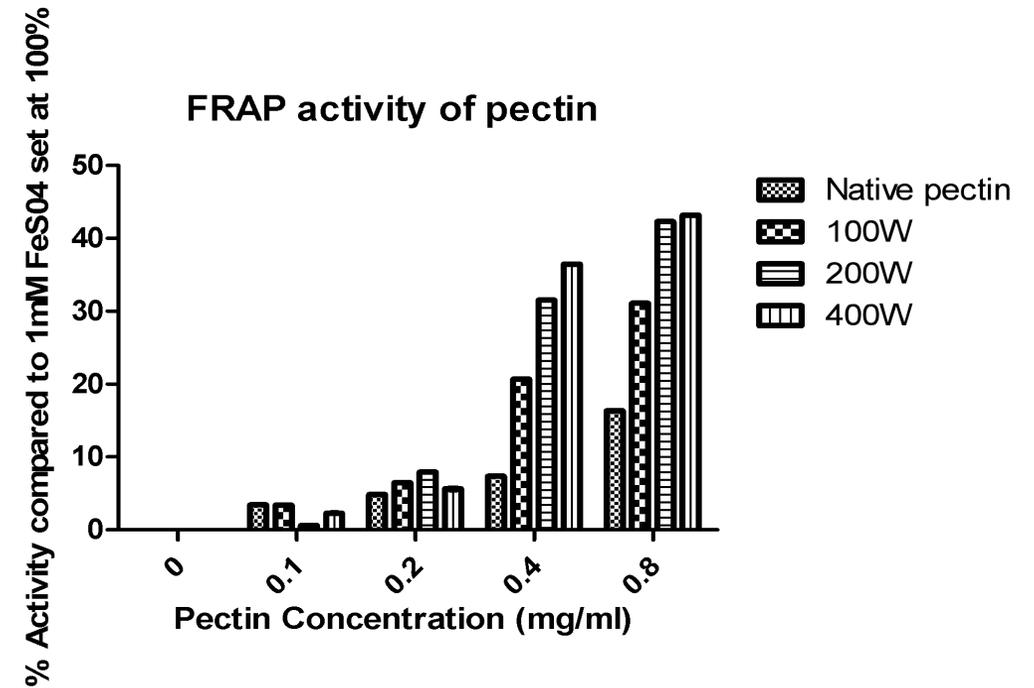


Sweet Potato Pectin

Compared with the native pectin, **the oxygen radical absorption capacity and ferric ion reduction activity of ultrasonic modified sweet potato pectin were significantly enhanced**, and were dose-dependent with pectin concentration.

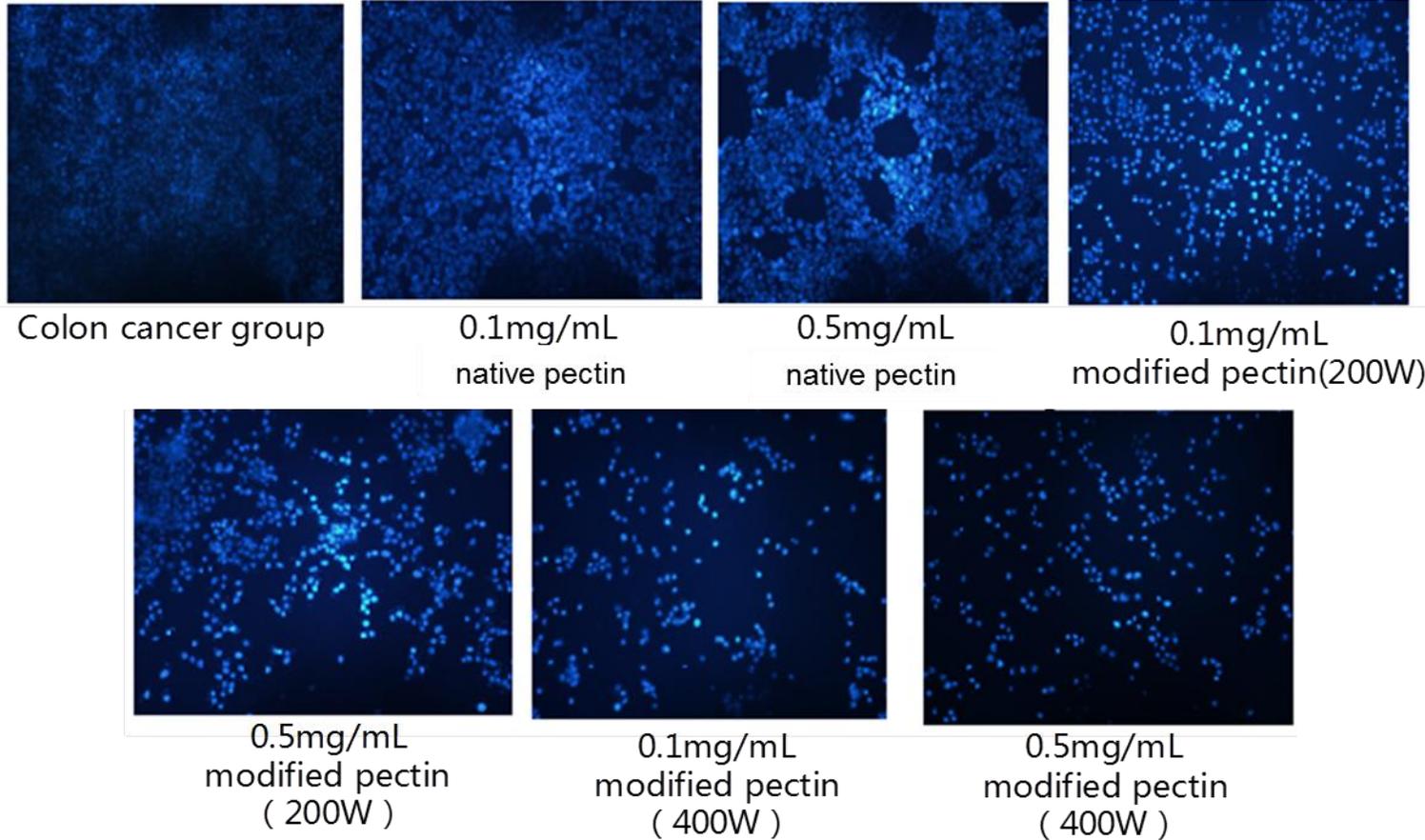


Oxygen radical absorption capacity of pectin modified by ultrasound



Ferric ion reduction activity of pectin modified by ultrasound





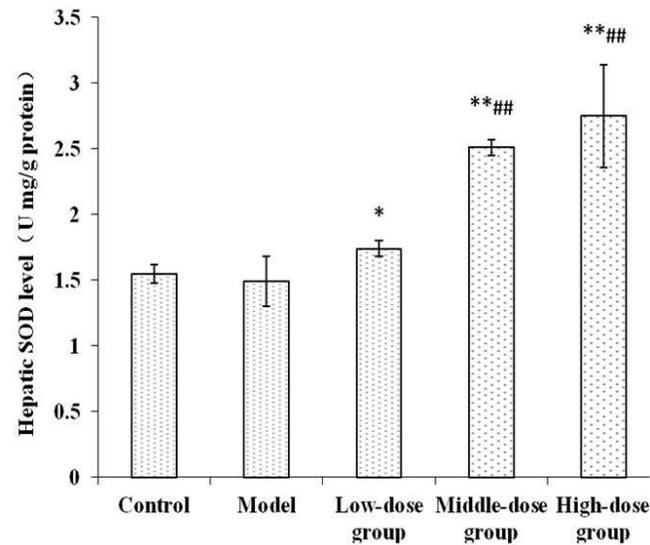
Sweet potato pectin can **inhibit the proliferation of colon cancer cell (HT-29)** and promote its apoptosis, 400W ultrasonic modified pectin has the best inhibition activity.

Effects of native and ultrasonic modified pectin on apoptosis of colon cancer cell (HT-29)

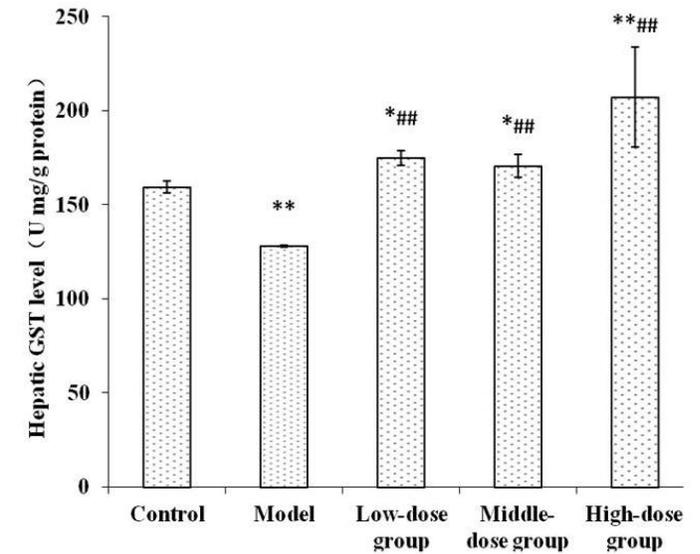


Purple Sweet Potato Anthocyanins

Purple sweet potato anthocyanins can increase the content of superoxide dismutase and glutathione transferase in the liver of mice with alcohol induced injury, indicating that it has a **protective effect on alcohol induced liver injury**.



Control: normal group



Effects of purple sweet potato anthocyanins on the contents of superoxide dismutase (SOD) and glutathione transferase (GST) in liver of mice with alcoholic liver damage



Sweet Potato Leaf Polyphenols



Phenolic acids

Flavonoids

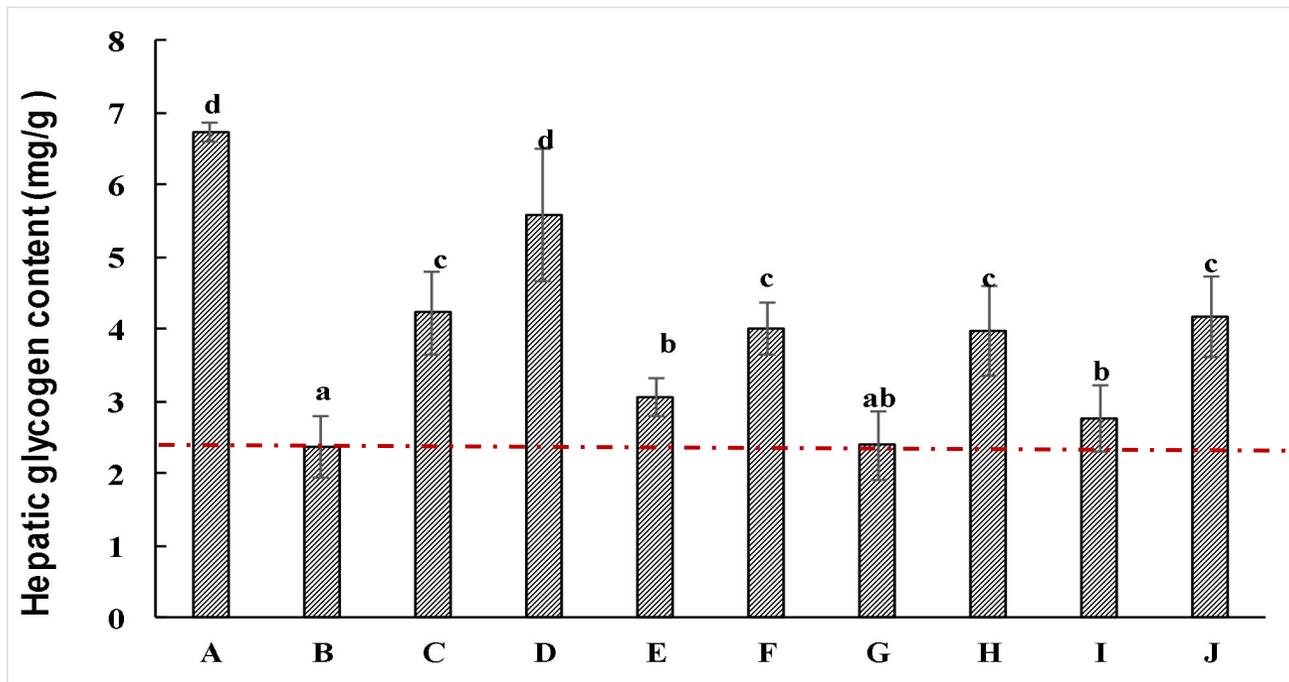
The **antioxidant activities** of sweet potato leaf polyphenols were higher than those of tea polyphenols and grape seed polyphenols.

Antioxidant activities of polyphenols from sweet potato leaves, tea and grape seeds

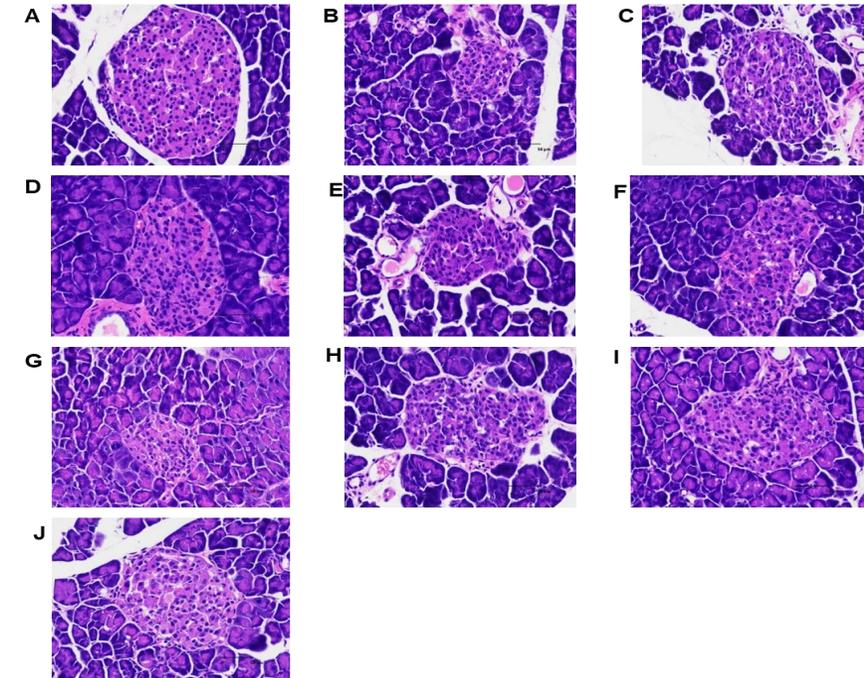
Samples	Concentration of samples (µg/mL)					
	5	10	20	5	10	20
	•O ₂ scavenging activity (µg ACE/mL)			oxygen radicals absorption capacity (µg TE/mL)		
Sweet potato leaf polyphenols	14.57±0.31 ^a	30.56±2.59 ^a	62.71±2.99 ^a	22.35±1.59 ^a	33.72±2.61 ^a	55.68±1.45 ^a
Tea polyphenols	3.60±0.28 ^b	7.29±0.31 ^b	10.62±0.45 ^b	16.67±2.98 ^b	32.23±1.22 ^a	43.53±0.59 ^b
Grape seeds polyphenols	3.02±0.11 ^c	3.18±0.42 ^c	6.73±0.12 ^c	13.75±0.62 ^b	29.21±1.68 ^b	43.54±0.77 ^b



Sweet potato leaf polyphenols can significantly slow down the weight loss of diabetes mice, **reduce blood glucose**, improve oral glucose tolerance, increase the synthesis of liver glycogen, and **protect islet cells from injury and atrophy**.



Effect of sweet potato leaf polyphenols on liver glycogen content in T2DM mice



Pathological analysis of pancreatic tissue of T2DM mice with H&E staining (200×)

Note: A, normal group; B, diabetic group; C, metformin group; D, sweet potato leaves powder; E, low dose sweet potato leaves polyphenols; F, high dose sweet potato leaves polyphenols; G, low dose ethyl caffeate group; H, high dose ethyl caffeate group; I, low dose kaempferol group; J, high dose kaempferol group.



