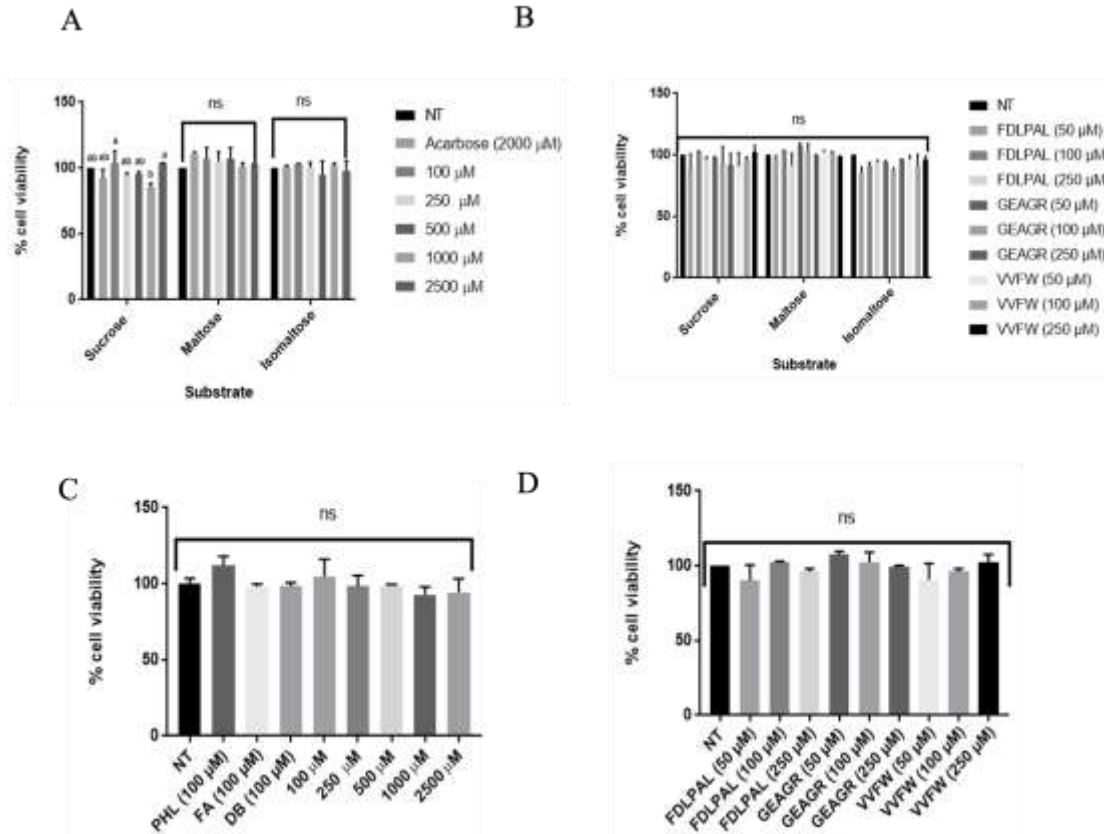
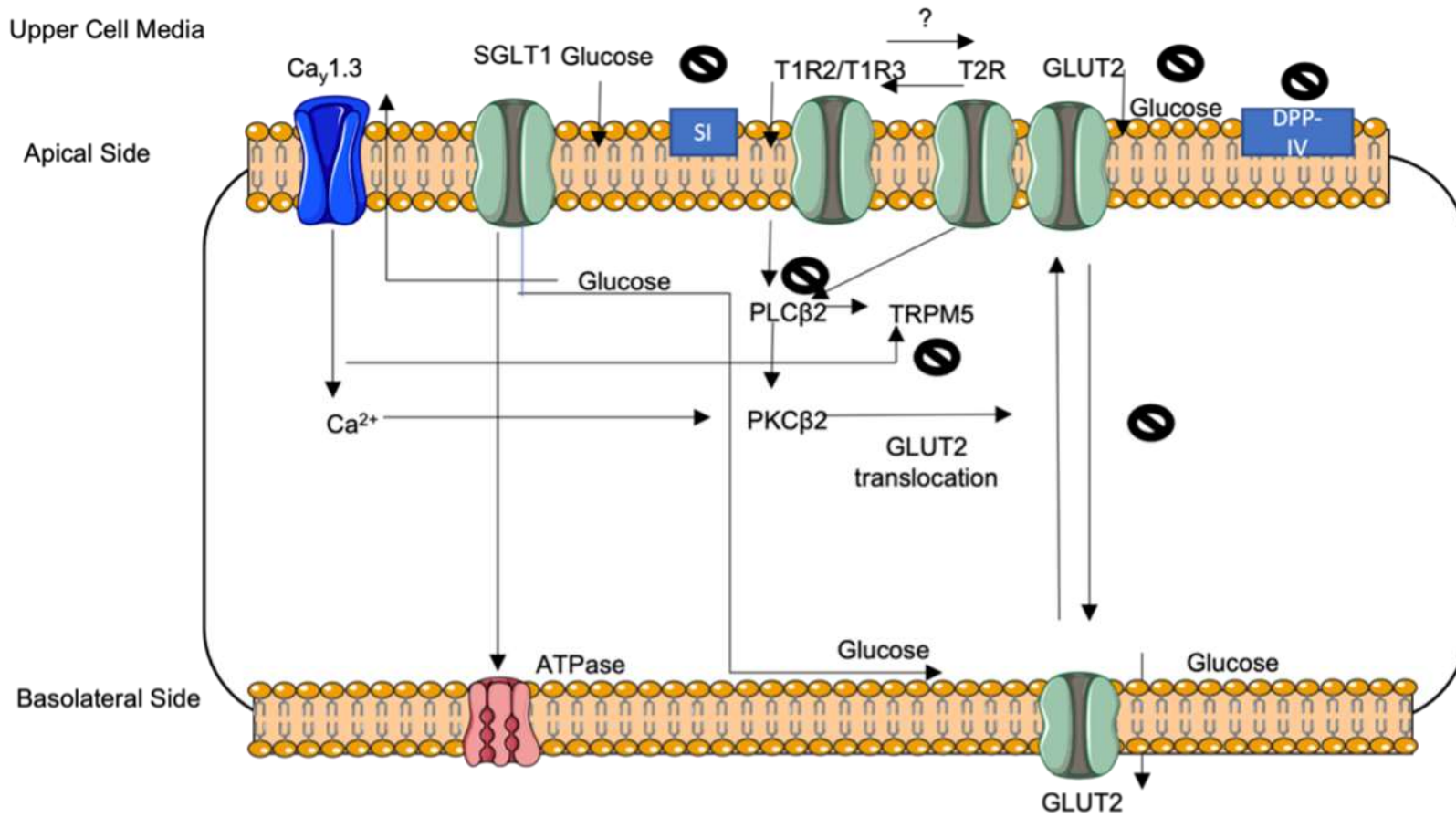


Supplementary Figure 1. LC-ESI-MS/MS technique used for peptide sequencing, specifically for peptide Valine-Valine-Phenylalanine-Tryptophan (VVFW). A. Mass spectrum of germinated chickpea protein hydrolysate; B. Final results of peptide sequencing.



Supplementary Figure 2. **A.** Cell viability of Caco-2 cells treated with germinated chickpea protein hydrolysate or positive control Acarbose (2 mM) and further stimulated with sucrose, maltose or isomaltose. **B.** Cell viability of Caco-2 cells treated with pure peptides FDLPAL, GEAGR, or VVFW and further stimulated with sucrose, maltose or isomaltose. **C.** Cell viability of Caco-2 cells treated with germinated chickpea protein hydrolysate or positive controls phloretin (PHL), flufenamic acid (FA) and denatonium benzoate (DB) and further stimulated with glucose. **D.** Cell viability of Caco-2 cells treated with pure peptides FDLPAL, GEAGR, or VVFW and further stimulated with glucose. Letters indicate significant differences ($p < 0.05$). NT: Non-treated cells; NS: Non-significant ($p > 0.05$). Bars indicate mean value obtained and error bars show standard deviation.

Supplementary Figure 3. Proposed mechanism of action.



Supplementary Table 1. Physicochemical, bioactive and bitterness properties of peptides identified in germinated chickpea protein hydrolysate from metabolic sources.

Peptide	Length	Mass (g/mol)	pI	Net charge	Hydrophobicity (kcal/mol)	Bioactive Properties	Bioactive peptide fragment(s)	Bitter fragments	Predicted activation of bitter receptors
STSA	4	364.16	5.51	0	9.57	ACE-inhibition	ST	N/A	hT2R1
						DPP-IV inhibition	TS		
VTPGGAR	7	656.36	11.10	1	12.44	ACE-inhibition	GA, GG, PG, AR, TP	R, P, PGG, V, PG	hT2R1, hT2R14, hT2R16, hT2R47, hT2R41, hT2R10, hT2R43, hT2R46, hT2R7, hT2R44, hT2R38, hT2R39, hT2R40, hT2R4
						DPP-IV inhibition	TP, GA, GG, PG, VT		
						Peptide regulating stomach mucosal membrane activity	PG		
						Antithrombotic peptide	PG		
TPVG	4	372.20	5.49	0	8.98	ACE-inhibition	VG, TP	P, V, VG	hT2R1, hT2R16, hT2R10, hT2R14, hT2R46, hT2R41, hT2R43
						DPP-IV inhibition	TP, PV, VG		
DAGLG	5	431.20	3.13	-1	13.09	ACE-inhibition	GL, AG, DA, LG		hT2R14, hT2R1, hT2R16,

						DPP-IV inhibition	GL, AG, DA, AG, GE	LG, GL, L, GLG, DA	hT2R41, hT2R39
						a-Glucosidase inhibition	EA		
GKGSPPGGVA	11	882.45	10.16	1	17.23	ACE-inhibition	GP, KG, GS, GV, GK, GG, SG, PG, GPP, PP, SGP	P, V, K, PP, GP, PPG, PGG, GV, GGV, KG, VA, PG	hT2R7, hT2R14, hT2R47, hT2R43, hT2R40, hT2R16, hT2R44, hT2R46, hT2R1, hT2R38, hT2R39, hT2R41, hT2R10, hT2R4
						Antithrombotic peptide	GP, PG		
						Peptide regulating stomach mucosal membrane activity	GP, PG		
						Antioxidative peptide	GPP		
						DPP-IV inhibition	GP, PP, VA, PPG, GG, GV, KG, PG		
						a-Glucosidase inhibition	PP		
						HMG-CoA reductase inhibitor	GGV		
						VPGGSR	7		

						DPP-IV inhibition	VP, GG, PG		hT2R41, hT2R43, hT2R10, hT2R46, hT2R47, hT2R7, hT2R39, hT2R38, hT2R44, hT2R40
						Antithrombotic	PG		
						Peptide regulating stomach mucosal membrane activity	PG		
GKSPVGGGK	10	882.49	10.65	2	18.38	ACE-inhibition	VG, GK, GG, PP	P, V, K, PP, VG	hT2R7, hT2R14, hT2R47, hT2R1, hT2R16, hT2R40, hT2R43, hT2R38, hT2R46, hT2R39, hT2R41, hT2R44, hT2R10, hT2R4
						DPP-IV inhibition	SP, GG, KS, PV, VG		
						α -Glucosidase inhibition	PP		
TPPVGGGGR	9	796.42	10.79	1	14.38	ACE-inhibition	VG, GR, GG, PP, TP	R, P, V, PP, VG, GR	hT2R7, hT2R14, hT2R47, hT2R43, hT2R16, hT2R46, hT2R40, hT2R1, hT2R44, hT2R38, hT2R39, hT2R10, hT2R41, hT2R4
						DPP-IV inhibition	PP, TP, GG, PV, VG		
						α -Glucosidase inhibition	PP		

SPLAPG	6	540.29	5.51	0	9.04	ACE-inhibition	PL, LAP, AP, LA, PG	P, L, PL, LA, PG	hT2R1, hT2R14, hT2R16, hT2R43, hT2R7, hT2R41, hT2R40, hT2R10, hT2R46, hT2R47, hT2R39, hT2R44, hT2R38
						DPP-IV inhibition	LA, AP, APG, SP, PL, PG		
						Antithrombotic	PG		
						Peptide regulating stomach mucosal membrane activity	PG		
LSPAGGK	7	628.35	10.14	1	12.85	DPP-IV inhibition	PA, SP, AG, GG	P, L, K, PA	hT2R1, hT2R16, hT2R14, hT2R41, hT2R47, hT2R43, hT2R7, hT2R10, hT2R46, hT2R38, hT2R39, hT2R44, hT2R40, hT2R4
						ACE-inhibition	LSP, LSPA, AG, GK, GG		
AKPSGGPVG	9	768.41	10.21	1	14.93	ACE-inhibition	GP, GPV, VG, GG, SG, KP	P, V, K, KP, GP, GGP, VG	hT2R7, hT2R14, hT2R47, hT2R40, hT2R43, hT2R1, hT2R44, hT2R16, hT2R46, hT2R41,
						DPP-IV inhibition	GP, KP, GG, PS, PV, VG, GPV		
						Peptide regulating	GP		

						stomach mucosal membrane activity			hT2R38, hT2R10, hT2R39, hT2R4
						Antioxidative	KP		
						Antithrombotic	GP		
TVAGKG	6	531.30	9.82	1	13.29	ACE-inhibition	AG, KG, GK	V, K, KG, VA	hT2R1, hT2R16, hT2R14, hT2R41, hT2R39, hT2R10
						DPP-IV inhibition	VA, AG, KG, TV		
TLGHPSGGGGAALV	14	1192.62	7.57	0	14.87	ACE-inhibition	AA, GA, GH, GG, SG, LG, HP	P, V, L, LG, LV	hT2R40, hT2R7, hT2R39, hT2R14, hT2R41, hT2R47, hT2R38, hT2R5, hT2R43, hT2R1, hT2R44
						Glucose uptake stimulation	LV		
						Hypotensive	AA		
						DPP-IV inhibition	GA, AL, AA, GG, GH, LV, PS, TL		
						Antioxidative	GAA		
GKGSAPSSGVA	11	916.46	10.16	1	16.21	ACE-inhibition	AP, KG, GS, GV, GK, SG	P, V, L, GV, KG, VA	hT2R7, hT2R14, hT2R40, hT2R47, hT2R1, hT2R39, hT2R41, hT2R43, hT2R38, hT2R16,
						DPP-IV inhibition	VA, AP, GV, KG, PS		

									hT2R44, hT2R46
SPAGAPG	7	555.26	5.51	0	11.94	ACE-inhibition	AP, GA, AG, PG	P, PA, PG	hT2R1, hT2R14, hT2R16, hT2R46, hT2R43, hT2R10, hT2R41, hT2R39, hT2R47, hT2R7, hT2R44
						Peptide regulating stomach mucosal membrane activity	PG		
						Antithrombotic	PG		
						DPP-IV inhibition	AP, PA, APG, SP, GA, AG, PG		
HPTASAGKG	9	824.41	9.94	1	17.18	ACE-inhibition	AG, KG, GK, PT, HP	P, K, KG	hT2R7, hT2R14, hT2R47, hT2R40, hT2R1, hT2R43, hT2R41, hT2R16, hT2R38, hT2R39, hT2R44, hT2R46, hT2R10
						DPP-IV inhibition	HP, TA, AG, AS, KG, PT		
GKGLSF	6	607.33	10.16	1	10.50	ACE-inhibition	GL, KG, GK, SF, GL	F, L, K, KG, GL	hT2R14, hT2R16, hT2R1, hT2R38, hT2R46, hT2R43,
						DPP-IV inhibition	KG, SF		

									hT2R47, hT2R7, hT2R39, hT2R10, hT2R44, hT2R4, hT2R40, hT2R41, hT2R9
HPSGGKGG	8	695.33	9.94	1	18.23	ACE-inhibition	KG, GK, GG, SG, HP	P, K, KG	hT2R7, hT2R14, hT2R16, hT2R1, hT2R43, hT2R38, hT2R47, hT2R39, hT2R46, hT2R41, hT2R44, hT2R10, hT2R40, hT2R4
						DPP-IV inhibition	HP, GG, KG, PS		
TKATAS	6	577.31	9.82	1	12.66	ACE-inhibition	KA	K	hT2R1, hT2R14, hT2R41, hT2R16, hT2R39
						DPP-IV inhibition	KA, TA, AS, AT, TK		
LPLL	4	454.31	5.58	0	4.29	ACE-inhibition	PL, LPL, LP	P, L, LL, PL	hT2R14, hT2R40, hT2R1, hT2R10, hT2R43, hT2R41, hT2R39, hT2R4, hT2R46, hT2R16, hT2R47,
						Glucose uptake stimulation	LL		
						Antioxidative	LPL		
						DPP-IV inhibition	LL, LPL, LP, PL		
						DPP-IV inhibition	VV, VF		

									hT2R38, hT2R7, hT2R44
FLDPAL	6	674.36	3.12	-1	7.97	DPP-IV inhibition	PA, FL, AL, DP	P, F, L, FL, LD, PA	hT2R14, hT2R7, hT2R43, hT2R40, hT2R47, hT2R46, hT2R44, hT2R1, hT2R38, hT2R10, hT2R4, hT2R39, hT2R16, hT2R41, hT2R45, hT2R8
GKGLSF	6	607.33	10.16	1	10.50	ACE-inhibition	GL, KG, GK, SF	F, L, K, GL, KG	hT2R14, hT2R16, hT2R1, hT2R38, hT2R46, hT2R43, hT2R47, hT2R7, hT2R39, hT2R10, hT2R44, hT2R4, hT2R40, hT2R41, hT2R9
						DPP-IV inhibition	GL, KG, SF		
VTPAGGR	7	656.36	11.11	1	12.44	ACE-inhibition	AG, GR, GG, TP	V, R, P, GR, PA	hT2R1, hT2R14, hT2R16, hT2R47, hT2R46, hT2R43, hT2R7, hT2R41, hT2R10,
						DPP-IV inhibition	PA, TP, AG, GG, VT		

									hT2R44, hT2R38, hT2R39, hT2R40, hT2R4
TPPAGGAAR	9	796.42	10.79	1	14.04	ACE-inhibition	AA, GA, AG, GG, AR, PP, TP	R, P, PP, PA	hT2R7, hT2R14, hT2R47, hT2R1, hT2R43, hT2R16, hT2R40, hT2R46, hT2R44, hT2R41, hT2R38, hT2R10, hT2R39, hT2R4
						Antioxidative	GAA		
						Hypotensive	AA		
						DPP-IV inhibition	PP, PA, TP, GA, AA, AG, GG		
						α -Glucosidase inhibition	PP		
PSPKGGGLG	9	768.41	10.59	1	14.79	ACE-inhibition	GL, KG, GG, LG	P, L, K, PK, LG, GL, GLG, GGL, GGLG, GGGL, GGGLG	hT2R7, hT2R14, hT2R47, hT2R16, hT2R43, hT2R1, hT2R38, hT2R46, hT2R40, hT2R44, hT2R39, hT2R41, hT2R10, hT2R4, hT2R9
						DPP-IV inhibition	SP, GL, GG, KG, PK, PS		
SPHLAGSGGGAALV	14	1192.62	7.63	0	14.43	ACE-inhibition	LA, AA, GA, AG, HL, GS, GG, SG, PH, AGS	P, V, L, LV, LA	hT2R40, hT2R7, hT2R39, hT2R41, hT2R14, hT2R5, hT2R47,

						Glucose uptake stimulation	LV		hT2R38, hT2R43
						Antioxidative	HL, GAA		
						Hypotensive	AA		
						DPP-IV inhibition	LA, SP, GA, HL, AL, AA, AG, GG, LV, PH		
SPGAGPA	7	555.26	5.51	0	11.94	ACE-inhibition	GPA, GA, AG, PG, AGP, GAGP	P, GP, PA, PG	hT2R1, hT2R14, hT2R16, hT2R46, hT2R43, hT2R10, hT2R41, hT2R39, hT2R47, hT2R7, hT2R44
						Antithrombotic	GP, PG		
						Peptide regulating stomach mucosal activity	GP, PG		
						DPP-IV inhibition	GP, PA, SP, GPA, GA, AG, PG		
HPATTGGKG	9	824.41	9.94	1	17.62	ACE-inhibition	KG, GK, GG, TG, HP	P, K, KG, PA	hT2R40, hT2R7, hT2R39, hT2R14, hT2R41, hT2R38, hT2R5, hT2R47, hT2R43, hT2R1
						DPP-IV inhibition	AT, GG, KG, TG, TT, HP, PA		
TKSGVS	6	577.31	9.82	1	12.56	ACE-inhibition	GV, SG	V, K, GV	hT2R1, hT2R14, hT2R16,
						DPP-IV inhibition	GV, KS, TK, VS		

						DPP-IV inhibition	PA, LP, AL		hT2R41, hT2R39
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Supplementary Table 2. Molecular docking of peptides identified by LC-ESI-MS/MS from germinated chickpea protein hydrolysate present in legumin.

	T2R4		T2R14	
	Energy of Affinity (kcal/mol)	Amino acid residues	Energy of Affinity (kcal/mol)	Amino acid residues
VVFW	-5.3	LEU181 [4.19], PHE189 [3.97], SER186 [3.27], SER243 [1.79], TYR250 [5.25], VAL182 [5.44, 5.45]	-10.5	ASN157 [2.25, 2.37], GLU255 [2.35], ILE148 [5.25], ILE262 [4.63, 5.41], PHE175 [3.79], SER169 [1.97], SER250 [2.64], SER254 [2.74], TRP89 [3.65, 3.76]
FDLPAL	-5.4	LEU181 [4.78], PHE189 [4.88], SER243 [2.03], TYR250 [4.28], VAL178 [5.25], VAL193 [4.99]	-9.7	ASN157 [2.03, 2.43, 2.95], GLU259 [3.07], ILE148 [4.07], LEU261 [5.02], PHE175 [3.63], PHE243 [3.78], PHE247 [4.81], SER167 [3.01, 3.12], SER169 [2.19], TRP66 [4.14], TRP89 [4.58, 5.22]
GEAGR	-5.9	GLN249 [2.78], LEU177 [2.90], LYS262 [2.84], MET89 [3.03], SER176 [2.73], SER180 [2.48, 3.19], SER184 [2.45], THR166 [2.70, 2.81, 3.39], TYR147 [2.86, 2.94]	-8.2	ASN157 [2.42, 2.73], GLU255 [2.27], PHE175 [3.61], SER167 [2.84], SER169 [2.24, 2.73], THR86 [2.35], TRP89 [3.90]