

β 1,3-Glucan: Silver Bullet or Hot Air?

V. Vetrivcka* and J. Vetrivckova

University of Louisville, Department of Pathology, Louisville, USA

Abstract: β -Glucans belong to a group of biologically active natural compounds called biological response modifiers. These substances represent highly conserved structural components of cell walls in yeast, fungi, gram and seaweed. The effects of β -glucan on immune reactions are well established however direct comparisons of the biological activities of several individual glucans are extremely rare. As this paper will show, we tested sixteen different glucans and evaluated the possibility whether individual glucans will be similarly active against each of the tested biological properties or if each glucan will affect different reactions. No direct connection between source and immunological activities was found. Based on our results, we can conclude that highly purified and highly active glucans have pleotropic effects, whereas poorly isolated glucans have only average (if any) biological effect.

CONCLUSION

Several conclusions can be made: 1) not all glucans are created equal; 2) some of the commercial glucans have surprisingly low activity; 3) most glucans strongly differ in biological effects based on tested characteristics, and 4) no clear relevance between the source of glucan and its activity has been found. Also, another important point is the fact that some of the glucans exhibited low activity. In these cases, however, you need up to 100x more of glucan to illicit high activity. This means that the low activity is not caused by a lower percentage of glucan but, rather, that the glucans with limited biological activities will not be comparable to the "better" glucans regardless of the dosage.

Table 1. Types of Glucan Used in this Study

Glucan	Source	Solubility	Manufacturer	Reference
Maitake Gold	Mushroom	Soluble	NutraGenesis, Brattleboro, VT	[6]
Krestin	Mushroom	Soluble	Kureha Corp, Japan	[5]
Aktival	Yeast	Insoluble	Farmal, Croatia	
Immutol	Yeast	Insoluble	Biotec ASA, Norway	[7]
Now Glucan	Yeast	Insoluble	Now Foods, Bloomingdale, IL	[7]
	Mushroom	Soluble		
Sweet Beta Glucan	Yeast	Soluble	K2 Global, Las Vegas, NV	
Beta Right 101	Yeast	Insoluble	Biothera, Eagan, MN	[26]
Epicor	Yeast	Insoluble	Vitamin Research Products, Carson City, NV	
NSC	Yeast	Insoluble	Nutritional Scientific Corp., Liberty, TX	[27]
Glucagel	Barley	Soluble	PolyCell Technologies, Crookston, MN	[7]
Better Immunity	Yeast	Insoluble	Young Again Nutrients, Magnolia, TX	
Macroforce	Yeast	Insoluble	ImmuneDyne, Houston, TX	[28]
Solgar	Yeast	Insoluble	Solgar, Leonia, NJ	
Wellmune	Yeast	Insoluble	Biothera, Eagan, MN	[26]
Swanson	Yeast	Insoluble	Swanson Health Products, Fargo, ND	
Glucan #300	Yeast	Insoluble	Transfer Point, Columbia, SC	[7]

Table 2. Effect of Dose on Stimulation of Phagocytosis

Dose (µg)	25	50	100	200	400	800
Maitake Gold	34.7 ± 2.4	35.5 ± 3.1	38.9 ± 3.1*	45.4 ± 4.1*	46.0 ± 4.0*	46.2 ± 4.2*
Krestin	36.2 ± 1.1	37.8 ± 2.1*	44.9 ± 2.5*	44.1 ± 3.5*	48.5 ± 4.4*	49.2 ± 3.9*
Aktival	31.1 ± 1.6	34.6 ± 2.0	38.9 ± 3.0*	40.2 ± 3.3*	41.1 ± 4.7*	40.5 ± 3.7*
Immutol	32.3 ± 2.1	35.5 ± 2.9	39.6 ± 3.3*	41.3 ± 4.1*	41.7 ± 3.5*	43.0 ± 4.1*
Now Glucan	36.2 ± 2.1	39.8 ± 1.1*	46.2 ± 2.5*	41.4 ± 3.0*	44.1 ± 3.6*	42.9 ± 3.8*
Sweet Beta Glucan	30.1 ± 2.2	31.2 ± 1.8	33.7 ± 2.3	34.1 ± 2.0	33.8 ± 2.4	37.8 ± 3.2*
Beta Right 101	35.1 ± 0.8	42.7 ± 2.7*	44.9 ± 3.0*	47.1 ± 3.3*	48.2 ± 3.8*	48.1 ± 2.1*
Epicor	30.1 ± 1.1	28.5 ± 3.2	30.6 ± 2.4	33.2 ± 3.3	35.6 ± 3.8	34.9 ± 4.6
NSC	29.9 ± 3.3	32.9 ± 2.5	31.6 ± 3.2	33.7 ± 3.8	35.7 ± 3.5	36.6 ± 2.9*
Glucagel	30.1 ± 1.7	32.5 ± 2.8	35.6 ± 2.1	37.1 ± 2.6*	36.9 ± 3.0*	38.0 ± 2.9*
Better Immunity	32.1 ± 0.8	33.6 ± 1.7	33.8 ± 3.0	35.5 ± 2.9	36.1 ± 4.2	34.2 ± 3.2
Macroforce	29.7 ± 3.0	30.6 ± 0.9	32.1 ± 2.8	33.6 ± 2.5	32.9 ± 5.1	33.8 ± 2.7
Solgar	30.1 ± 3.1	31.2 ± 2.2	32.5 ± 4.4	31.1 ± 2.4	34.8 ± 2.5	33.2 ± 2.9
Wellmune	28.5 ± 2.8	35.0 ± 2.1	42.1 ± 3.0*	44.2 ± 3.1*	44.7 ± 2.5*	45.9 ± 3.7*
Swanson	27.9 ± 1.2	30.1 ± 2.3	33.5 ± 2.7	35.2 ± 2.2	34.7 ± 1.9	35.9 ± 4.1
Glucan #300	44.1 ± 2.5*	48.8 ± 2.1*	55.7 ± 3.2*	56.1 ± 2.9*	55.9 ± 3.2*	60.9 ± 4.0*

Table 3. Effects of Glucan on Superoxide Anion Production

Glucan	superoxide anion (nanomoles per 2.5×10^5 cells)		
	Mouse neutrophils	HL-60	U937
Maitake Gold	$1.38 \pm 0.22^{**}$	$1.45 \pm 0.33^{**}$	$1.54 \pm 0.25^{**}$
Krestin	$1.17 \pm 0.33^{**}$	$1.02 \pm 0.26^{**}$	$1.11 \pm 0.15^*$
Aktival	0.36 ± 0.09	0.27 ± 0.11	$0.65 \pm 0.23^*$
Immutol	$0.67 \pm 0.12^*$	$0.67 \pm 0.24^*$	$1.02 \pm 0.34^*$
Now Glucan	$1.27 \pm 0.09^{**}$	$0.98 \pm 0.11^{**}$	$1.07 \pm 0.22^*$
Sweet Beta Glucan	$0.44 \pm 0.07^*$	$0.30 \pm 0.06^*$	$0.66 \pm 0.15^*$
Beta Right	$1.12 \pm 0.15^{**}$	$1.23 \pm 0.16^{**}$	$1.30 \pm 0.25^{**}$
Epicor	$0.49 \pm 0.16^*$	$0.34 \pm 0.24^*$	0.45 ± 0.11
NSC	0.44 ± 0.15	$0.35 \pm 0.08^*$	$0.71 \pm 0.16^*$
Glucagel	$1.49 \pm 0.33^{**}$	$1.50 \pm 0.41^{**}$	$1.43 \pm 0.38^{**}$
Better Immunity	$0.78 \pm 0.12^*$	$0.98 \pm 0.16^*$	$1.11 \pm 0.18^*$
Macroforce	$0.56 \pm 0.20^*$	$0.55 \pm 0.09^*$	$0.97 \pm 0.24^{**}$
Solgar	0.37 ± 0.06	$0.22 \pm 0.04^*$	$0.69 \pm 0.17^*$
Wellmune	$1.01 \pm 0.23^*$	$0.99 \pm 0.18^{**}$	$1.24 \pm 0.20^{**}$
Swanson	$0.87 \pm 0.17^*$	$0.25 \pm 0.03^*$	$0.77 \pm 0.12^*$
Glucan #300	$1.69 \pm 0.34^{**}$	$1.55 \pm 0.27^{**}$	$1.81 \pm 0.35^{**}$
PBS	0.23 ± 0.07	0.11 ± 0.02	0.33 ± 0.06

Table 4. Effects of Glucan on Nitrite Oxide Production

Glucan	Nitrite oxide	$(\mu\text{mol/L})$	
	Mouse neutrophils	HL-60	U937
Maitake Gold	4.11 ± 0.11	3.98 ± 0.23	5.79 ± 0.43
Krestin	5.27 ± 0.78	4.98 ± 0.66	5.56 ± 1.11
Aktival	5.04 ± 0.57	3.87 ± 0.87	5.52 ± 0.54
Immutol	2.99 ± 0.77	3.68 ± 0.54	4.61 ± 0.99
Now Glucan	5.99 ± 0.68	6.01 ± 1.12	7.21 ± 1.07
Sweet Beta Glucan	2.88 ± 0.44	4.01 ± 0.95	4.24 ± 1.01
Beta Right	4.61 ± 0.87	5.55 ± 0.99	6.12 ± 1.22
Epicor	4.33 ± 1.54	3.75 ± 0.89	4.87 ± 0.98
NSC	3.78 ± 0.66	3.86 ± 0.75	4.44 ± 1.04
Glucagel	6.46 ± 1.06	5.15 ± 0.78	6.69 ± 1.25
Better Immunity	2.98 ± 1.43	3.78 ± 1.01	4.99 ± 0.98
Macroforce	3.56 ± 0.55	4.72 ± 0.87	5.01 ± 0.99
Solgar	4.55 ± 1.07	4.88 ± 1.01	5.11 ± 1.27
Wellmune	7.01 ± 1.77	5.36 ± 0.79	6.98 ± 1.21
Swanson	4.22 ± 0.99	4.87 ± 2.02	4.98 ± 1.78
Glucan #300	7.87 ± 1.55	6.26 ± 1.77	8.37 ± 2.03
PBS	0.24 ± 0.04	0.09 ± 0.02	0.31 ± 0.05

Table 5. Effect of Glucan on Secretion of IL-2

Glucan	IL-2 (pg/ml)
Maitake Gold	695.7± 23.9
Krestin	601.2 ± 109.5
Aktival	445.7 ± 95.7
Immutol	326.5 ± 99.6
Now Glucan	525.6 ± 109.5
Sweet Beta Glucan	237.3 ± 67.4
Beta Right	678.1± 156.3
Epikor	113.8 ± 27.8
NSC	267.1 ± 50.5
Glucagel	206.7 ± 56.4
Better Immunity	156.0 ± 33.9
Macroforce	358.9 ± 87.1
Solgar	89.9 ± 33.4
Wellmune	711.2 ± 167.5
Swanson	177.8 ± 36.6
Glucan #300	983.9 ± 122.8
Con A	1 047.6 ± 287.7