



Comparison of immunological effects of commercially available β -glucans

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Abstract

Biological and most of all immunological effects of natural immunomodulator glucan are already well established. However, since hundreds of individual glucans, isolated from various sources, used at different concentrations and having different physicochemical characteristics are being used, the current scientific knowledge is not complete. In addition, direct comparisons of individual glucans are quite rare. In the present paper, we tested fifteen varieties of glucans differing in source and solubility. Whereas no direct connection between source and immunological effects was found, we can conclude that the best glucans have pleiotropic effects stimulating all facets of immunological reactions, whereas other glucans have low effects or none at all.

Conclusions

Our study clearly demonstrated that there are severe differences in immunological activities among our selected group of glucans. Similarly to our previous study [16], we tested fifteen varieties of glucans differing in source and solubility. Based on previous studies, we included Glucan #300 as the benchmark. We confirmed that some glucans can have significant effect on some defense reactions, whereas have little or no activity on others (e.g., Qore Defence had no activity on tumor suppression, but stimulated antibody secretion). Several glucans consistently showed higher biological activities, most of all Immunox 3-6, Glucan Real, Beta-Glucan (Germany) or Reishi, but in every tested reaction, the Glucan #300 was the most active sample. The differences between individual glucans found in this report might explain the sometimes confusing results published in the literature. It is clear that the immunological and biological effects of individual glucan are not connected to their source or solubility.

Table 1. Types of glucan used.

Glucan	Source	Solubility	Manufacturer
Beat Max	Yeast	Insoluble	Chisolm Biological Laboratories, Aiken, SC
Oat Beta Glucan	Oat	Insoluble	Health Breakthroughs, Lake Oswego, OR
Bio-Glucan	Yeast	Insoluble	Pharma Nord, Vojens, Denmark
Qore defense	Mushroom	Insoluble	Quivana, Provo, UT
Immunox 3-6	Yeast	Insoluble	Xymogen, Orlando, FL
Betacan 500	Yeast	Insoluble	Arrowhead Healthworks, Cedarpine Park, CA
Glucan Real	Mushroom	Soluble	QueGen Biotech, South Korea
MC-Glucan	Mushroom	Soluble	Macrocare Tech, South Korea
Beta Glucan (Germany)	Yeast	Insoluble	Biotikon, Germany
Barley Glucan	Barley	Insoluble	Sigma, St. Louis, MO
Beta Glucan	Mushroom/yeast	Partly soluble	Vitabase, Monroe, GA
Reishi	Mushroom	Soluble	Hostdefence, Olympia, WA
Beta Glucan	Yeast	Insoluble	Greenpath, Wrightsville Beach, NC
Hliva ustrictna	Mushroom	Insoluble	Walmart, Trinec, Czech Republic
Glucan #300	Yeast	Insoluble	Transfer Point, Columbia, SC

Dose (mg)	25	50	100	200	400	800
BetaMax	33.1±2.9	30.9±3.1	35.1±4.2	37.7±3.2'	38.8±3.5'	37.9±2.9'
Oat Beta Glucan	30.7±1.9	32.5±2.7	34.1±2.8	33.6±2.6	35.5±3.7	36.2±2.8
Bio-Glucan	32.5±2.6	34.1±2.5	38.8±3.1'	40.2±3.0'	42.8±3.3'	44.1±3.1'
Qore defense	30.9±2.2	33.7±2.9	34.9±3.2	35.9±3.1	36.6±1.8	36.8±4.2
Immunox 3-6	38.5±2.2'	39.9±3.3'	43.4±4.1'	45.3±3.1'	46.2±4.1'	46.9±3.2'
Betacan 500	32.1±1.8	33.2±2.8	34.8±3.3	36.6±2.8	35.8±2.9	37.7±3.2
Glucan Real	31.8±1.8	34.2±3.3	37.1±1.2'	40.2±1.7'	42.2±1.9'	44.4±2.9'
MC-Glucan	31.8±1.6	34.1±0.9	34.1±2.7	38.1±1.9	38.9±2.2	40.7±2.2
Beta Glucan (Germany)	32.6±2.2	35.1±2.1	37.1±1.8'	37.9±2.2'	38.1±1.9'	41.1±2.1'
Barley Glucan	31.8±1.1	32.1±0.8	33.1±0.9	34.1±2.1	35.8±3.2	34.8±2.2
Beta Glucan (Vitabase)	32.6±2.2	32.6±0.8	33.1±1.9	32.9±2.3	34.7±2.8	35.1±4.3
Reishi	31.7±0.7	33.1±0.9	35.6±1.9	37.6±1.0'	38.9±2.4'	40.6±2.7'
Beta Glucan (Greenpath)	30.9±0.9	31.8±1.1	33.1±1.5	34.0±1.1	34.6±2.3	35.1±3.3
Hliva ustricna	31.5±1.1	32.8±2.1	34.1±2.4	35.2±3.0	34.7±2.4	35.1±2.8
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. Effect of individual glucans on superoxide anion production.

Glucan	Mouse neutrophils (nmol/2.5x10⁵ cells)	HL-60
BetaMax	1.12±0.11*	1.23±0.25*
Oat Beta Glucan	0.35±0.05	0.44±0.11
Bio-Glucan	1.44±0.23*	1.48±0.37*
Qore Defense	0.65±0.24*	0.64±0.15*
Immunox 3-6	1.07±0.25*	1.22±0.21*
Betacan 500	0.87±0.30*	0.79±0.29*
Glucan Real	1.31±0.25*	1.43±0.36*
MC-Glucan	1.44±0.41*	1.55±0.26*
Beta Glucan (Germany)	0.78±0.22*	0.99±0.32*
Barley Glucan	0.38±0.09	0.43±0.12
Beta Glucan (Vitabase)	0.78±0.13*	0.88±0.23*
Reishi	0.99±0.23*	1.12±0.34*
Beta Glucan (Greenpath)	0.76±0.22*	0.89±0.24*
Hliva ustricna	0.56±0.12*	0.75±0.21*
Glucan #300	1.69±0.34*	1.55±0.27*
PBS	0.25±0.08	0.35±0.07

Table 4. Effect of individual glucans on IL-2 and IFN- γ secretion.

Glucan	IL-2 (pg/ml)	IFNγ (pg/ml)
BetaMax	78.3 \pm 8.9	25.3 \pm 1.9
Oat Beta Glucan	62.2 \pm 5.5	41.2 \pm 2.5
Bio-Glucan	363.3 \pm 14.4	65.2 \pm 4.0
Qore Defense	30.1 \pm 2.1	30.3 \pm 2.4
Immunox 3-6	611.1 \pm 83.9	116.1 \pm 7.8
Betacan 500	87.9 \pm 6.6	27.9 \pm 2.1
Glucan Real	442.2 \pm 87.5	82.3 \pm 2.5
MC-Glucan	459.9 \pm 64.4	59.9 \pm 2.4
Beta Glucan (Germany)	223.6 \pm 11.8	103.6 \pm 5.8
Barley Glucan	12.9 \pm 1.1	22.3 \pm 1.0
Beta Glucan (Vitabase)	230.8 \pm 11.3	39.8 \pm 1.1
Reishi	288.8 \pm 24.4	128.5 \pm 4.9
Beta Glucan (Greenpath)	174.4 \pm 36.6	84.0 \pm 6.2
Hliva ustricna	39.9 \pm 3.2	9.9 \pm 0.8
Glucan #300	983.9\pm122.8	201.2\pm11.5
Con A	1 103.3 \pm 291.2	ND
PBS	0	2.1 \pm 0.2

Table 5. Effect of individual glucans on suppression of breast cancer.

Glucan	Tumor weight (mg)
BetaMax	512.7±49.9
Oat Beta Glucan	501.7±45.5
Bio-Glucan	499.1±46.2
Qore Defense	501.3±33.7
Immunox 3-6	348.9±40.2*
Betacan 500	522.3±47.8
Glucan Real	467.7±34.7*
MC-Glucan	511.8±40.1
Beta Glucan (Germany)	476.2±38.8*
Barley Glucan	611.6±53.6
Beta Glucan (Vitabase)	512.8±42.4
Reishi	411.1±32.7*
Beta Glucan (Greenpath)	601.0±52,3
Hliva ustrictna	603.5±55.6
Glucan #300	286.1±23.5*
PBS	622.6±52.5

Table 6. Effect of individual glucans on antibody formation.

Glucan	% of control
BetaMax	102.4±10.8
Oat Beta Glucan	111.6±21.2
Bio-Glucan	125.4±14.8
Qore Defense	133.1±12.5*
Immunox 3-6	296.1±17.2*
Betacan 500	128.3±20.3
Glucan Real	201.3±18.5*
MC-Glucan	129.9±9.9
Beta Glucan (Germany)	207.6±16.8*
Barley Glucan	111.9±11.0
Beta Glucan	130.6±14.8
Reishi	189.8±14.7*
Beta Glucan	126.1±17.2
Hliva ustrictna	109.2±9.8
Glucan #300	343.9±43.1*
Ovalbumin+adjuvant	509.9±45.5*