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Comparison Study to Determine Immunity Activation Effectiveness Produced by Functional Food Extracts with Proposed Immunity Stimulation Effects

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Introduction Brolico is a newly discovered phytonutrient found in broccoli. It was first identified during a collaborative research project conducted by Imagine Global Care Co., Ltd., University of Tokyo and Genome Pharmaceuticals Institute. Further studies have indicated that when consumed in extracted form, the purified brolico nutrient is able to produce high levels of cellular activity within crucial white blood cells, in effect, raising natural immunity. In order to establish the overall effectiveness of the brolico nutrient, a comparison study of various well-known natural immunity activating extracts was conducted using a new active assay (silkworm muscle contraction), which was originally developed by faculty at Tokyo University Department of Pharmaceutical Sciences.

Natural Immunity

Immunity is the means by which the body protects itself from external threats, such as disease-causing germs and bacteria. There are two different kinds of immunity, natural (or innate) immunity and acquired (or adaptive) immunity. Natural immunity, a system that all animals have, includes white blood cells that work to eat bacteria, virally infected cells, and cancerous cells. On the other hand, acquired immunity includes white blood cells that create various toxin specific antibodies using stored memory from previous encounters with each toxin.

Method

It has been suggested that silkworms suffer from the same viruses and diseases as human beings and can be treated with the same medicines, making them viable candidates for research.

Faculty members at Tokyo University Department of Pharmaceutical Sciences discovered that when injecting a silkworm with a component that activates natural immunity, such as a bacteria or fungus, the muscles of the silkworm gradually shrink (Patent 8313779). This occurs because when an activated component binds with the immune cell of the silkworm, active oxygen is released, and a specific protein is activated, which causes the muscle to contract. (Announced in International Academic Journal, 2008).

Thus, when administering a component which produces the effect of immunity stimulation (as

indicated by the silkworm's muscle contraction), the degree of the contraction may be measured to determine the precise level of specific activity (immunity activation) produced by the given component.

For the purpose of this study, 10 extracts attributed with immunity stimulating effects were selected as samples for comparison: brolico, ß-glucan, fucoidan, lentinan, DHA, EPA, açaí, propolis, broccoli sprout and sulforaphane.

Traditional extraction methods were determined to be ineffective for obtaining the brolico phytonutrient, thus a customized extraction method was developed, which facilitated a higher specific activity (Japan Patent No. 5491082). This same method was used to extract samples for açaí and broccoli sprouts. Traditional extraction methods were used to obtain samples of ß-glucan, fucoidan, lentinan, DHA, EPA, propolis, and sulforaphane.

Extracts were administered in equal 1 milligram units, and specific activity was recorded using the silkworm method of measurement. Specific activity measurements were recorded after a cumulative of at least three independent experiments per sample, and include +/– calculations for standard error.

Results

The findings are consistent with the hypothesis that the extract of brolico phytonutrient would produce the highest level of specific activity, measuring approximately 770 units of per milligram. Extract of propolis produced the lowest level of immunity activation, measuring less than 0.4 units per milligram. Sulforaphane performed lower than expected, measuring less than 7 units per milligram.

Measurements of each extract's performance (units of specific activity per milligram), as well as the comparison evaluation, can be found in Table 1.

Conclusion

In conclusion, the results suggest brolico to be capable of producing extraordinarily high levels of natural immunity stimulation, much higher those produced by its counterparts. Thus, there appears a significant benefit to further research on a much broader scale, specifically in regards to human trials.

Table 1. Natural immunity performance comparison of immune stimulation extracts

Nutrient Extract	Specific Activity (units/mg)	Performance Comparison
Brolico	770	
β-Glucan	14	approx 50x more
Fucoidan	12	approx 60x more
Lentinan	290	approx 2.6x more
DHA (Fish Oil)	< 10	70x more
EPA (Fish Oil)	< 4	190x more
Acai (Crude extracts)	3.1	approx 240x more
Propolis (Ethanol Extracts, Crude Extracts)	< 0.4	1000x more
Broccoli Sprout (Crude Extracts)	< 18	40x more
Sulforaphane	< 7	100x more

Appendix 1: Measurement of Brolico Extract

Brolico phytonutrient was extracted from broccoli vegetable using the patented extraction method (Japan Patent No. 5491082). Upon administering 1 milligram of brolico extract, specific activity (immunity activation), as measured by degree of muscle contraction, reached 770 units (Figure 1).

Immunity Activation of Brolico: 770 units/mg

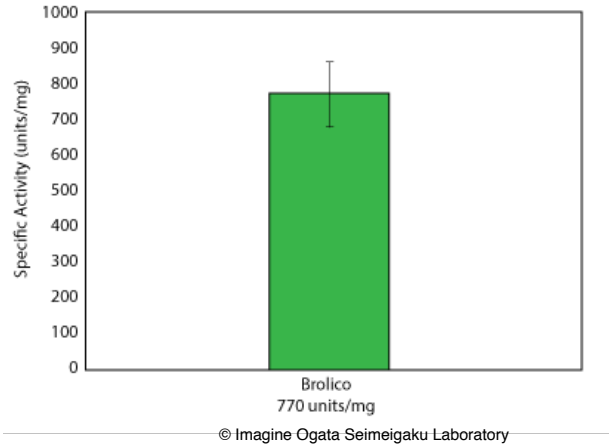

Figure 1. Specific activity of brolico phytonutrient, as measured by silkworm muscle contraction.

Appendix 2: Measurement of ß-glucan Extract

ß-glucan was extracted from agaricus mushroom. Upon administering 1 milligram of ß-glucan extract, specific activity (immunity activation), as measured by degree of muscle contraction, reached 14 units (Figure 2).

Immunity Activation of ß-glucan: 14 units/mg

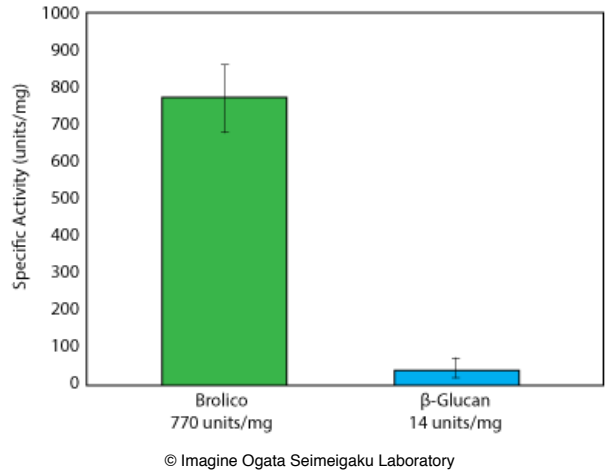

Figure 2. Specific activity of brolico in comparison to ß-glucan, as measured by silkworm muscle contraction.

Appendix 3: Measurement of Fucoidan Extract

Fucoidan was extracted from mekabu wakame (seaweed). Upon administering 1 milligram of fucoidan extract, specific activity (immunity activation), as measured by degree of muscle contraction, reached 12 units (Figure 3).

Immunity Activation of Fucoidan: 12 units/mg

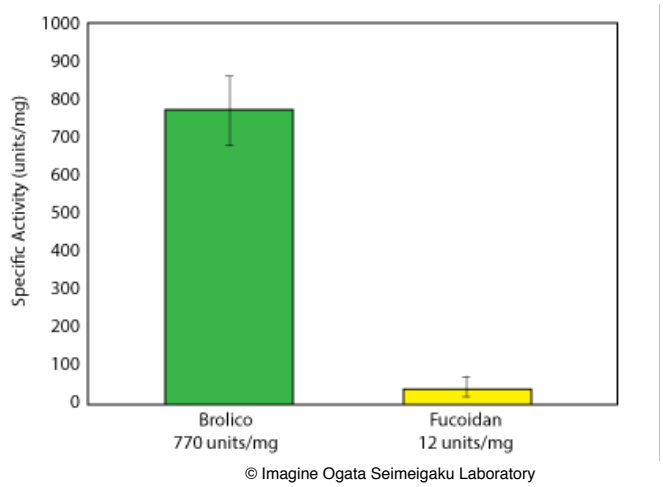

Figure 3. Specific activity of brolico in comparison to fucoidan, as measured by silkworm muscle contraction.

Appendix 4: Measurement of Lentinan Extract

Lentinan was extracted from shiitake mushroom. Upon administering 1 milligram of lentinan extract, specific activity (as measured by degree of muscle contraction), reached 290 units (Figure 4).

Immunity Activation of Lentinan: 290 units/mg

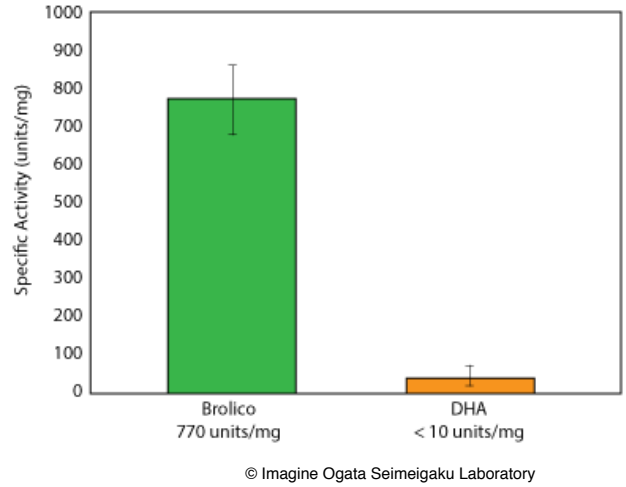

Figure 4. Specific activity of brolico in comparison to lentinan, as measured by silkworm muscle contraction.

Appendix 5: Measurement of DHA Extract

Docosahexaenoic acid (DHA) was extracted from fish oil. Upon administering 1 milligram of DHA extract, specific activity (as measured by degree of muscle contraction), was less than 10 units (Figure 5).

Immunity Activation of DHA: < 10 units/mg

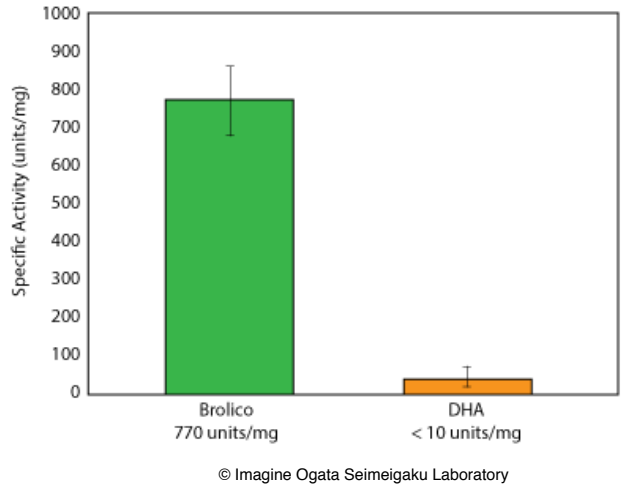

Figure 5. Specific activity of brolico in comparison to DHA, as measured by silkworm muscle contraction.

Appendix 6: Measurement of EPA Extract

Eicosapentaenoic acid (EPA) was extracted from fish oil. Upon administering 1 milligram of EPA extract, specific activity (as measured by degree of muscle contraction), was less than 4 units (Figure 6).

Immunity Activation of EPA: < 4 units/mg

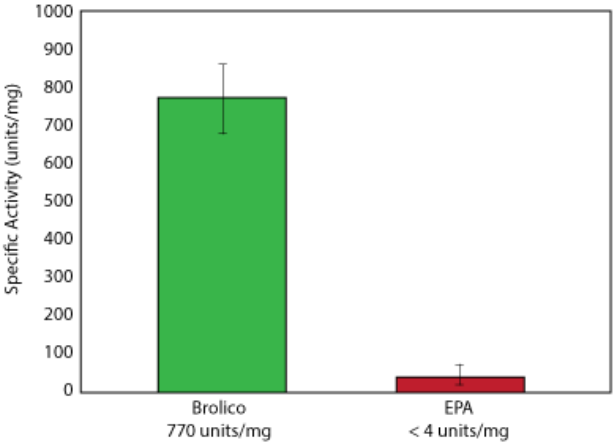

Figure 6. Specific activity of brolico in comparison to EPA, as measured by silkworm muscle contraction.

Appendix 7: Measurement of Açaí Extract

Açaí was extracted using the patented extraction method (Japan Patent No. 5491082). Upon administering 1 milligram of açaí extract, specific activity (as measured by degree of muscle contraction), reached 3 units (Figure 7).

Immunity Activation of Açaí: 3 units/mg

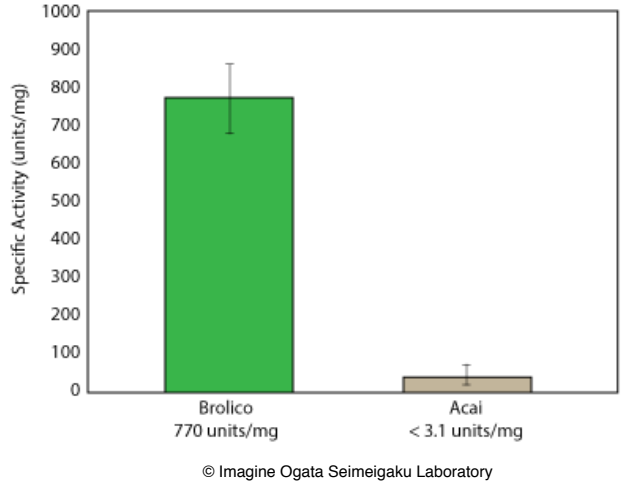

Figure 7. Specific activity of brolico in comparison to açaí, as measured by silkworm muscle contraction.

Appendix 8: Measurement of Propolis Extract

Propolis was extracted from bee hive resin using ethanol as a solvent. Upon administering 1 milligram of propolis extract, specific activity (as measured by degree of muscle contraction), was less than 0.4 units (Figure 8).

Immunity Activation of Propolis: < 0.4 units/mg

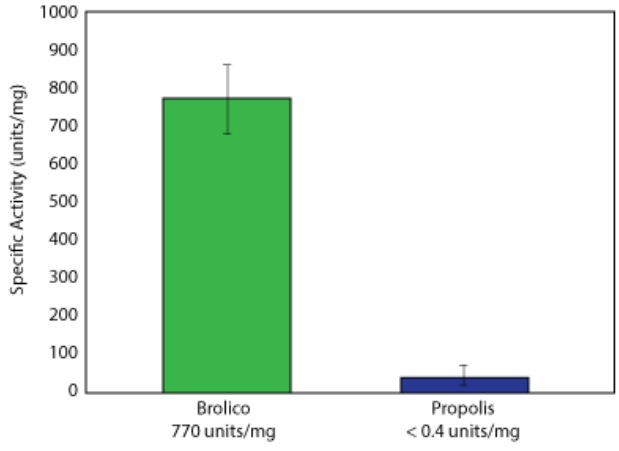

Figure 8. Specific activity of brolico in comparison to propolis, as measured by silkworm muscle contraction.

Appendix 9: Measurement of Broccoli Sprout Extract

Broccoli sprouts (grown from germinated broccoli seeds) was extracted using the patented extraction method (Japan Patent No. 5491082). Upon administering 1 milligram of broccoli sprout extract, specific activity (as measured by degree of muscle contraction), was less than 18 units (Figure 9).

Immunity Activation of Broccoli Sprout: < 18 units/mg

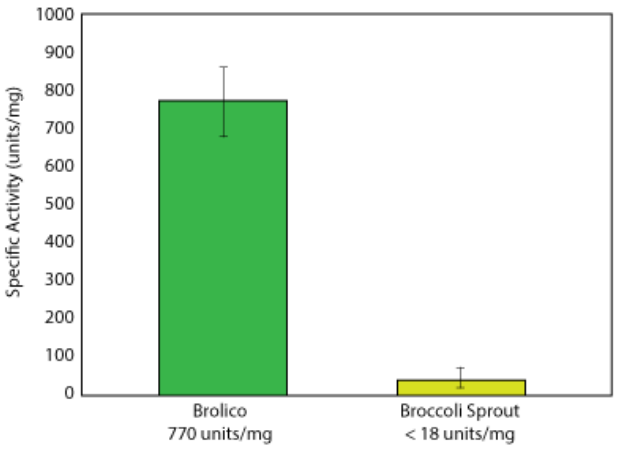

Figure 9. Specific activity of brolico in comparison to broccoli sprouts, as measured by silkworm muscle contraction.

Appendix 10: Measurement of Sulforaphane Extract

Sulforaphane was refined from germinated broccoli seed with 90% purity retained. Upon administering 1 milligram of sulforaphane extract, specific activity (as measured by degree of muscle contraction), was less than 7 units (Figure 10).

Immunity Activation of Sulforaphane: < 7 units/mg

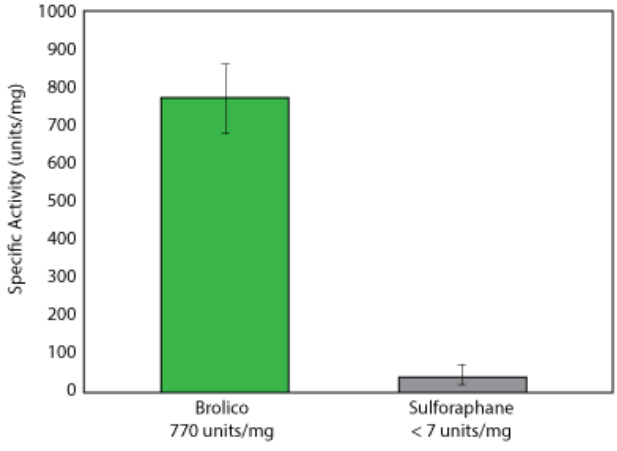

Figure 10. Specific activity of brolico in comparison to sulforaphane, as measured by silkworm muscle contraction.