COMPARISON OF IMMUNOLOGICAL EFFECTS OF COMMON IMMUNOMODULATORS

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Abstract

Nowadays, foods with health benefits have become very popular. Functional foods and dietary supplements are regularly introduced into our diet. However, not all natural extracts are created equal and products differ widely in composition and, subsequently, in quality and activity. Inexpensive and effective natural immunomodulators represent a holy grail of current alternative medicine. Some have been extensively studied for decades with an impressive number of peer-reviewed scientific papers (such as beta-glucan), some have good reputation but give confusing results based on isolation sources (such as Echinacea). To date, very few papers have compared individual immunomodulators. Based on the limited published comparisons, we decided to compare numerous commercially available immunostimulators. In order to establish which of the common immunomodulators is superior, we directly compared the immunological activity of commercial samples of beta-glucan, elderberry, essential oils, Astragalus, ellagic acid, Echinacea, Chlorella, Cat's claw and ginseng.

In our study we decided to test the effects of 14 day oral supplementation of mice on cellular immunity (phagocytosis and NK cell activity), on humoral immunity (IL-2 production and antibody formation) and on reduction of breast cancer. Our results clearly demonstrated that among all tested supplements, only beta-glucan offered consistent immunoenhancing activities and in all tests, beta-glucan showed the highest activity.

Several conclusions can be made, most of the commercial immunostimulating compounds have only very limited, if any, effects on the immune system including cancer. In addition, doses recommended on the label might not be sufficient, but no solid data on dosages exist with the exception of beta-glucan. From our results, we can conclude that beta-glucans are by far the most active immunomodulators and that the use of other immunomodulators represents

Materials and Methods

Phagocytosis: 60 minute incubation of peripheral blood cells with HEMA particles.

NK cell activity: Spleen cell suspensions from mice injected with individual samples were generated by pressing minced spleen against the bottom of a petri dish containing PBS. After elimination of erythrocytes, the cells were resuspended in PBS and counted. Splenocytes (106/ml; 0.1 ml/well) in V-shaped 96-well microplates were incubated 50 µl of target cell line YAC-1 at the final effector-target ratio 100:1. After spinning the plates at 250x g for 5 min, the plates were incubated for 4 hr at 37oC. The cytotoxic activity of cells was determined by the use of CytoTox 96 Non-Radioactive Cytotoxicity Assay from Promega (Promega, Madison, WI, USA).The optical density was determined by using a STL ELISA reader (Tecan U.S., Research Triangle Park, NC) at 492 nm.

IL-2 production: Purified spleen cells (2x106/ml in RPMI 1640 medium with 5% FCS) obtained from mice injected with 100 mg tested samples were added into wells of a 24-well tissue culture plate. Cells were incubated for 48 hrs in a humidified incubator. At the endpoint of incubation, supernatants were collected, filtered through 0.45 mm filters and tested for the presence of IL-2 using a Quantikine mouse IL-2 kit.

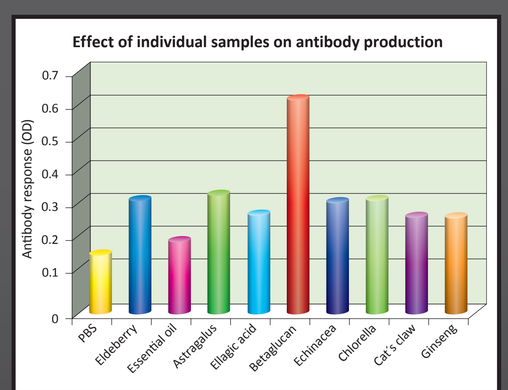
Antibodies: Formation of antibodies was evaluated using ovalbumin as an antigen. Mice were injected twice (two weeks apart) with 0.1 mg of ovalbumin and the serum was collected 7 days after last injection. Experimental groups were supplemented daily with 100 mg of tested material. The level of specific antibodies against ovalbumin was detected by ELISA. As a positive control, a combination of ovalbumin and Freund's adjuvant was used.

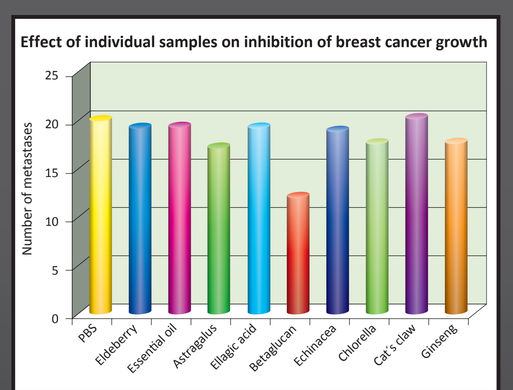
Breast cancer: Mice were injected directly into the mammary fat pads with 1x106/mouse of Ptas64 cells in PBS. The experimental treatment was begun after palpable tumors were found. Experimental treatment was achieved by oral feeding of tested samples diluted in PBS (once/day for 14 days). After treatment, the mice were sacrificed, tumors removed and weighed.

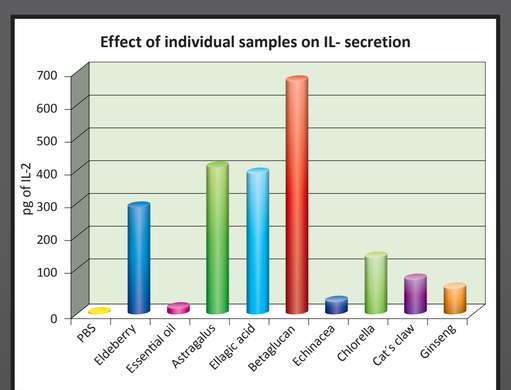
Introduction

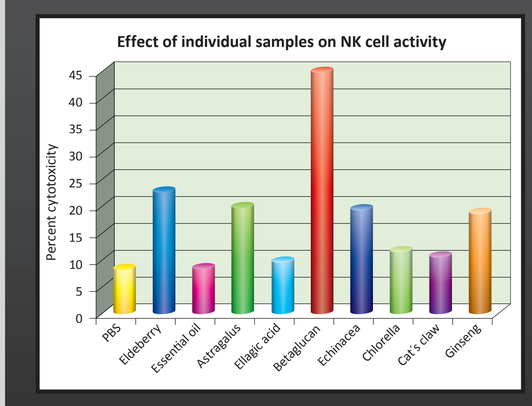
To use natural products as a possible remedy is weaved into the history of mankind. People have been appealing to nature for curing various diseases since ancient times. Alternative therapy, also known as complementary medicine, refers to a variety of therapies and practices that usually falls out of the scope of traditional medicine. These health practices include acupuncture, homeopathy, herbal medicine, special diets, and aromatherapy, and are frequently used both in addition to and in place of, conventional treatment. Dietary supplements are preparations that conceptually fall into an in-between category that lies somewhere between food and drugs. Quite often, the line is not distinct. Hundreds and hundreds of different botanicals are used in complementary and alternative medicine or as a part of healthy nutrition. While there's some anecdotal evidence, an increasing amount of interested researchers and lately even more clinical studies of the mechanisms on how different herbs elicit clinical effects are not well described and remain largely unknown. Out of an estimated 250,000 flowering plant species globally, between 50,000 and 70,000 are known to be used in traditional and modern medicine. That does not mean they are all active, as only about 6% have been screened for biological activity. Despite this lack of knowledge, botanical supplements are used worldwide with the expectation of boosting immune responses and reducing various pathogen-associated symptoms. The purpose of this study was to directly compare the immunological activity of 9 different commercially available natural immunomodulators.

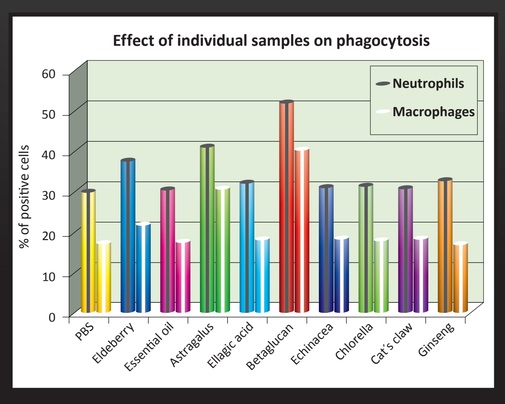
Results











Conclusions

- Direct comparative studies of individual immunomodulators are extremely rare.
- In this study we evaluated 9 commercially available natural immunomodulators.
- We studied both cellular (phagocytosis, NK cell activity) and humoral (antibodies, IL-2) branch of immunity and added the model of breast cancer.
- Our results clearly showed that beta-glucan has superior immunomodulating activities which were not achieved by any of the tested immunomodulators.

The authors declare no conflict of interest.