Inhibition of Growth and Aflatoxin Production of Aspergillus parasiticus by Constituents of Herbal Drugs

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Aflatoxins (AF) are carcinogenic metabolites produced by certain strains of *Aspergillus flavus* and *Aspergillus parasiticus*. Since aflatoxinogenic fungi are widely distributed in tropical and subtropical areas, many commodities, including grains, nuts, and spices, are frequently contaminated with the toxins. It has been reported that inhibitory effects on the growth and toxin production of aflatoxinogenic fungi are found in several constituents of herbal drugs and spices. Cinnamon shows such an effect on fungal growth, and its constituents, cinnamaldehyde, o-methoxycinnamaldehyde and eugenol, also exhibit strong inhibitory effect. In the present work, we investigated the inhibitory effect of many herbal drugs and their constituents on the growth and toxin production of aflatoxinogenic fungi.

Each sample powder of herbal drugs was inoculated with a conidium suspension of *Aspergillus parasiticus* RIB 1037 and incubated at 30°C for 4 d under 98% relative humidity. Among sixty-two samples of herbal drugs examined, active fungal growth and marked production of AF were recognized on ten. AF production was low or not detected, in spite of active fungal growth, on thirty-one samples. On the other twenty-one samples, the fungi did not grow actively. These results suggest that many herbal drugs have inhibitory effect on the fungal growth and AF production. Twenty-five sample powders of herbal drugs were extracted with methanol at 50°C for ten h. The methanol extract was added to a powdered medium designed for investigation of the fungal growth and AF production at various concentrations. The medium was inoculated with a conidium suspension and incubated as described above.

In Moutan bark and Magnolia bark, the fungal growth and AF production were remarkably inhibited at a final concentration of 2%. In Phellodendron bark, Coptis Rhizome, and Glycyrrhiza, the fungal growth was active but AF production was reduced. From an extract of Moutan bark, paenol was isolated as the inhibitory constituent. Paenol completely inhibited the fungal growth at 0.5%. Magnolol and honokiol from Magnolia bark showed marked and almost complete inhibition, respectively, of the fungal growth and AF production. Berberine and glycyrrhetic acid did not inhibit fungal growth, but did inhibit AF production.

In Perilla herb, the production of AF B group was much higher than that of AF G group. When the methanol extract of Perilla herb was added to the powdered medium, AF B level increased, while AF G level decreased dependent upon the concentration of the extract. Two active substances were isolated from Perilla herb and identified as dill apiol and elemicin. The former exhibited strong activity, but the latter only weak activity. This effect was also found in myristicin, known to be a constituent of Perilla herb, and in magnolol. It is suggested that these substances act as inhibitors in the conversion from AF B to AF G in the fungi.