

# Guaraná, a supplement rich in caffeine and catechin, modulates cytokines:

## Evidence from human in vitro and in vivo protocols

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guaraná powder is an antiobesogenic supplement; however, its effect on inflammatory biomarkers has not yet been determined. Therefore, this study analysed whether guaraná supplementation can differentially modulate the levels of proinflammatory cytokines [interleukin 6 (IL-6), tumour necrosis factor-alpha, interleukin 1 beta (IL-1 $\beta$ ), interferon-gamma (Ig- $\gamma$ )] and anti-inflammatory interleukin 10 (IL-10) from in vitro and in vivo protocols. In the pilot in vitro protocol, human peripheral blood mononuclear cells were exposed to guaraná, as well as to resveratrol, quercetin and ascorbic acid as positive controls. The effect of guaraná on cytokine levels was also evaluated in culture medium supplemented with glucose and insulin. A randomised, placebo-controlled in vivo assay was also performed to evaluate the potential influence of guaraná on the blood cytokine levels of 14 healthy volunteers supplemented for 14 days. The effect of guaraná was similar to that of resveratrol, a known anti-inflammatory molecule, decreasing IL-1 $\beta$ , IL-10 and Ig- $\gamma$  levels and increasing IL-10 levels compared to those of the control group. The in vitro insulin supplementation potentiated the effect of guaraná on some cytokines. A decreasing effect on the blood inflammatory cytokine levels, along with an increase in IL-10 levels, was also observed in volunteers supplemented with guaraná. In

conclusion, guaraná positively modulates cytokines associated with inflammatory metabolism. ©

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Cytokines

Guaraná

Inflammation

Metabolic disorders

Paullinia cupana

Ascorbic acid

Blood

Glycoproteins

Insulin

Metabolism

Phenols

Cytokines

Decreasing effect

Healthy volunteers

Human peripheral blood

Inflammation

Metabolic disorders

Paullinia cupana

Tumour necrosis factor alphas

Flavonoids

Cyamopsis tetragonoloba

Paullinia cupana