Caffeine and exercise may be protective against skin cancer caused by sun exposure

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The combined effects of exercise plus caffeine consumption may be able to ward off skin cancer and also prevent inflammation related to other obesity-linked cancers.

"We found that this combination treatment can decrease sunlight-caused skin cancer formation in a mouse model," said Yao-Ping Lu, Ph.D., associate research professor of chemical biology and director of skin cancer prevention at the Rutgers Ernest Mario School of Pharmacy in Piscataway, N.J. He presented these findings at the AACR Annual Meeting 2012, held here March 31 - April 4.

"I believe we may extrapolate these findings to humans and anticipate that we would benefit from these combination treatments as well," Lu added.

The researchers evaluated the effects of caffeine and exercise on mice at high risk for developing skin cancer. Results showed that mice that took a dose of caffeine and exercised with a running wheel experienced 62 percent fewer skin tumors. The volume of tumors also decreased by 85 percent compared with the mice that did not consume caffeine or exercise.

Positive effects were found with either caffeine or exercise alone, but to a lesser extent. Researchers observed a 27 percent reduction in tumors in caffeine-only mice and a 61 percent reduction in tumor size. In the exercise-only mice, researchers found that tumor activity decreased by

35 percent and tumor volume decreased by 70 percent.

The researchers also found that exercise and caffeine reduced weight and inflammation. They fed mice a high-fat diet of omega-6 fatty acid-rich foods and measured the volume of the parametrial fat pad (the largest fat pad in a mouse) after two weeks of exercise and/or caffeine treatment.

Mice that had caffeine and exercised had a fat pad weight decrease of 63 percent. Caffeine-only mice had a 30 percent decrease, and exercise-only mice had a 56 percent decrease. Development and size of cancer decreased as well. The link, Lu believes, is inflammation, which dropped as much as 92 percent in mice that exercised and consumed caffeine.

More information: Oral caffeine during voluntary exercise markedly inhibits skin carcinogenesis and decreases cytokines associated with inflammation in UVB-treated mice

Abstract
In previous studies, we found that treatment of female SKH-1 mice with either oral administration of caffeine or voluntary running wheel exercise (RW) inhibited the formation of UVB-induced skin tumors. In the present study, we determined whether RW in combination with oral caffeine has a synergistic inhibitory effect on UVB-induced skin carcinogenesis.
UVB-pretreated female high-risk SKH-1 mice (7-8 weeks of age, total 160 mice) have no tumors but they develop tumors in the absence of further UVB irradiation over the next several months. These high-risk mice (40 mice per group) were then treated with water (control), caffeine (0.1 mg/ml in drinking fluid), RW or caffeine together with RW for 14 weeks. Although there were no differences in body weight between the four groups during the course of the study, treatment with caffeine increased running wheel activity by 40% when compared with

RW alone. Treatment of the mice with caffeine, RW or caffeine together with RW decreased skin tumors per mouse by 27, 35 and 62%, respectively, and the tumor volume per mouse was decreased by 61, 70 and 85%, respectively.

In mechanistic studies, female SKH-1 mice were treated with water (control), caffeine (0.1 mg/ml), RW, or a combination of caffeine plus RW for 2 weeks. All mice were then exposed to a single dose of UVB (30 mJ/cm2) and sacrificed before (control) and at 0.1, 0.5, 1, 2, 4, 6, 10, 16, 24, and 48 h post UVB. The results showed that mice treated with oral caffeine for 2 weeks increased RW activity by 22% when compared with the mice treated with RW alone. Treatment of mice orally with caffeine, RW, or a combination of caffeine and RW for 2 weeks (a) decreased the weight of the parametrial fat pads by 30, 56 and 63%, respectively, (b) stimulated the formation of UVB-induced apoptotic sunburn cells in the epidermis by 21, 124 and 298% at 6 hours post-UVB, and stimulated the formation of UVB-induced caspase 3 (active form) positive cells in the epidermis by 30, 164 and 333%, respectively at 6 hours post-UVB. Combination treatment of the mice had a small but significant inhibitory effect on cell proliferation as measured by bromodeoxyuridine incorporation into DNA in the epidermis.

Antibody array with 40 cytokines associated with inflammation revealed that oral caffeine together with RW administered to mice fed a high fat diet rich in omega-6 fatty acids for 2 weeks significantly decreased the UVB-induced increases in the levels of LIX, sTNF R1 and MIP-1γ as well as several other cytokines associated with inflammation. Our results indicate that voluntary exercise in combination with oral caffeine exerts a stronger effect than either treatment alone for decreasing tissue fat, increasing UVB-induced apoptosis, lowering the levels of cytokines associated with inflammation and for inhibiting UVB-induced carcinogenesis in UVB-pretreated high-risk mice.