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The Effects of Curcumin on ERα, p53, and p21 in the MCF-7 Breast Cancer Cell Line

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Curcumin is a golden-yellow flavonoid compound derived from the turmeric plant root that has been used in Chinese and Indian medicine for centuries. Curcumin has been shown to have antioxidant and anti-inflammatory properties, and because of this, has been gaining traction in the field of cancer research. Breast cancer is the most commonly diagnosed cancer in women, and is the second leading cause of cancer death in women, next to lung cancer. Because of the prevalence and mortality of breast cancer, possible therapeutics must be investigated. Due to the beneficial properties of curcumin and pervasiveness of breast cancer, we have decided to investigate their relationship. Our study examines the effects of curcumin, alone and in combination with hormones and anti-hormones, on ERα, p53, and p21 expression in the MCF-7 breast cancer cell line. We utilized western blot analyses, cellular viability assays, and confocal microscopy to gather our data. In order to deplete any endogenous steroids or effectors, breast cancer cells were cultured in a medium containing 5% charcoal-stripped fetal bovine serum for six days before treatment. Western blot analysis revealed significant downregulation of ERα in a concentration-dependent manner when cells were treated with increasing concentrations of curcumin (5μM-100μM). In the hormone studies, when curcumin (40μM) is combined with estradiol, it significantly downregulates ERα, even more so than when either compound is used on its own. This demonstrates the additive effects of curcumin, and that it is able to compete with the estrogen and anti-estrogens for receptor binding. The effects of curcumin on p53 are also promising. In the concentration studies, western blotting revealed a significant concentration-dependent increase in p53 levels with increasing concentrations of curcumin (5μM-100μM). Lastly, the effects of curcumin on p21 show a significant concentration-dependent increase in p21 levels with increasing concentrations of curcumin (5μM-100μM). Cellular viability studies show a significant decrease in cellular proliferation after treatment with curcumin, similar to the levels seen with antiestrogens ICI and tamoxifen. Overall, the effects of curcumin on the MCF-7 breast cancer cell line show significant downregulation of ERα, significant upregulation of p53 and p21, and a significant decrease in breast cancer proliferation. This constellation of findings is promising, and our studies provide a groundwork for further investigation of this compound as it relates to breast cancer progression clinically.