Curcumin may be a new ally in fighting brain cancer

Tests with animals indicate that the substance that gives color to curry inhibits the growth of brain tumors

A few years ago, curcumin, the active ingredient of turmeric (*Curcuma longa*) responsible for the yellow-orange coloring of curry, has been gaining ground in health and wellness magazines and websites. With known anti-inflammatory and antioxidant properties, the benefits attributed to the natural pigment range from reducing body fat, preventing and fighting Parkinson's and Alzheimer's disease, to inhibiting the growth of brain cancer.

Curcumin, the active ingredient of the turmeric, has anti-inflammatory and antioxidant properties – Photo: Steven Jackson/Flickr

Researchers at the Center of Oxidative Stress Research and the Laboratory of Enzymology of UFRGS' Department of Biochemistry identified cellular mechanisms by which cancer cells reproduce and investigated the potential of curcumin in the treatment of glioblastomas, a malignant and quite aggressive brain tumor. Tests with cell cultures (*in vitro*) and with animals (*in vivo*) indicate that the substance decreases the size of tumors and increases the survival of animals without causing damage to healthy cells.

The researchers implanted tumor cells in 22 mice. Half of them received the curcumin-based treatment dissolved in the solvent dimethyl sulfoxide for ten days, while the other half, the vehicle group, received only the solvent. Nine of the eleven mice treated with curcumin showed decrease in tumor size, which did not occur with any of the animals in the vehicle group. In addition, no signs of oxidative toxicity or changes in tissues, metabolism or blood were observed. “It is a natural, effective and non-harmful compound,” summarizes Professor José Cláudio Moreira, one of those responsible for the work.

Before reaching curcumin, a number of substances that could function as inhibitors of NFκB, a protein complex found overestimated in glioblastoma cells and that plays a key role in controlling the formation and progression of tumors and in resisting to chemotherapy, have been tested. Thus, NFκB inhibitory molecules are potential anticancer agents capable of potentiating the effect of traditional drugs. Among the substances analyzed by the group, curcumin was the most efficient and has the potential to be a great ally in the fight against glioblastoma.

Traditional treatments for the disease include surgical removal, external radiation therapy, and chemotherapy; however, there is no known cure for this cancer. The mean survival time of patients is about one year after diagnosis. “Any therapy that prolongs the lives of these people is considered promising,” says Alfeu Zanotto Filho, who participated in the research during his doctorate and postdoctoral degree and currently teaches at the Department of Pharmacology of the Federal University of Santa Catarina (UFSC). “If patients have six months to organize their lives, it makes a big difference,” adds Professor Daniel Gelain.

One of the challenges for treating the disease is the difficulty of the available drugs in reaching the brain. The organ has a highly selective barrier that protects the central nervous system from potentially toxic substances present in the blood. The problem is that this barrier also makes it difficult for certain drugs to reach the brain, including traditional chemotherapy.

To overcome this problem and potentiate the effects of curcumin in the treatment of brain tumors, the researchers, in partnership with groups from UFRGS' Faculty of Pharmaceutical Sciences, developed nanocapsules of curcumin and compared their effects with the pure substance. Its lipid-based formulation facilitates the delivery of the drug to the brain. Therefore, the nanocapsule proved to be more effective than curcumin in its traditional format, allowing the same results to be obtained with a dosage of 33 times lower. The nanocapsules also reduced tumor aggressiveness, providing lower incidences of intratumoral bleeding and necrosis, and increased survival of the animals.

The last stage of preclinical tests evaluated the efficacy of the combination of curcumin and temozolomide (TMZ), a chemotherapy drug traditionally used in the treatment of cancers. The tests showed that the combination did not result in a significant reduction of tumors when compared to TMZ alone. The study indicated that autophagy, a cellular "autodigestion" process that allows the degradation and recycling of damaged cellular organelles, is one of the mechanisms involved in this resistance of tumors to the combination of substances. According to the researchers, the inhibition of this phenomenon makes glioblastoma cells more susceptible to the action of curcumin and TMZ and may lead to the discovery of new treatments for brain tumors.

Next Steps

Having the preclinical phase completed, the next step is to test with humans. This step, however, has no date yet to begin. Although the group already has some defined partnerships, such as Porto Alegre Clinicas Hospital and São Vicente de Paulo Hospital, in Passo Fundo, partnerships with private companies interested in financing the research will be necessary in order to proceed with the study. According to Professor José Cláudio, the costs involved in clinical trials are too high to be covered only with public resources: “There are many expenses with quality control, analysis, logistics, payment of doctors and other professionals involved. The cost is much higher than producing basic science,” he says. “The major limitation is finding who buys the ideas and turns them into a commercial product,” adds Alfeu.

In addition to the researchers of the Department of Biochemistry and the Faculty of Pharmaceutical Sciences, also collaborated with the work members of UFRGS’ Department of Organic Chemistry and Laboratory of Pathology, Porto Alegre Clinicas Hospital, Center for Chemical, Pharmaceutical and Food Sciences of Federal University of Pelotas (UFPel), São Vicente de Paulo Hospital, Medical School of the University of Passo Fundo (UPF) and University of Texas Health Science Center at San Antonio, in the United States.

Translated by Camila Wisnieski Heck, under the supervision and translation revision of Professor Elizamari R. Becker (PhD/UFRGS).

Scientific Articles

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