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LE Magazine September 2006

**REPORT**

## **Omega-3 Fatty Acids Show Promise in Fighting Deadly Cancers**

By Julius G. Goepf, MD



Owing to the limitations of conventional cancer treatments, a growing number of researchers have turned their attention to nutritional therapies that interfere with cancer cell propagation via different mechanisms. Among these promising therapies are omega-3 fatty acids, which exhibit a variety of striking biochemical effects that may be valuable in preventing and even helping to treat certain cancers.<sup>1-3</sup>

For example, researchers have uncovered remarkable evidence that these fatty acids may impede cancer cell proliferation, potentially preventing it from spreading (metastasizing) throughout the body.<sup>4</sup>

For those who have already been treated for cancer, omega-3 fatty acids may even support recovery by preventing some of the debilitating complications that can follow surgery to remove cancer.<sup>5</sup>

In this article, we survey recent studies illuminating the promising role of omega-3s in fighting the deadly scourge of cancer.

### **Higher Omega-3 Intake Tied to Lower Cancer Risk**

In light of limited success in treating deadly cancers, cancer prevention has become a major focus in the war on cancer. For more than three decades, scientists have accumulated evidence that diets rich in fish may have protective effects against cancer.

For example, people living in areas where high fish consumption is the norm, such as Japan and Norway, have markedly lower rates of cancer than people elsewhere in the world.<sup>6-8</sup> By contrast, a “Western-style” diet that is relatively low in omega-3 fatty acids from fish oil is associated with rising cancer rates,<sup>9</sup> possibly due to its content of saturated and trans fatty acids and its overabundance of omega-6 fatty acids.<sup>10</sup>

# Omega-3 Fats Induce Varied Cancer-Preventive Effects

Scientists are now beginning to understand the specific mechanisms by which omega-3 fatty acids may help prevent cancer. For example, these protective fats alter genetic signaling in cells, preventing them from becoming cancerous in the first place.<sup>11</sup> Omega-3 fats may also “reprogram” damaged genes so that they are no longer able to contribute to the initiation of cancer.<sup>12</sup> Furthermore, omega-3 fatty acids reduce the production of inflammatory molecules that are considered vital in the initiation and progression of cancer.<sup>13,14</sup> In fact, these essential fats work to “switch off” production of certain molecules needed for cancer cell growth,<sup>13,15</sup> while “switching on” genes that cause cells to die before they can begin to form full-blown tumors.<sup>16</sup>

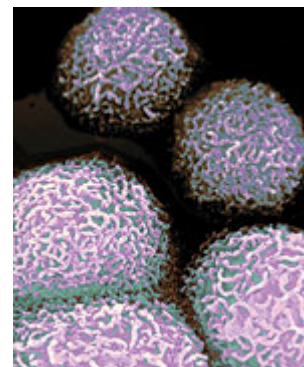
Omega-3 fatty acids may also fight cancer by promoting a healthy balance of fatty acids in the body. Omega-6 fatty acids, which are found in foods such as vegetable oils, eggs, and poultry, are very common in the American diet. However, an abundance of omega-6 fats relative to omega-3 fats can set the stage for cancer as well as heart disease.<sup>17</sup> While omega-6 fats contribute to the production of pro-inflammatory compounds, omega-3 fats help produce anti-inflammatory compounds. Thus, an imbalance of omega-6 relative to omega-3 fatty acids contributes to inflammation. Omega-3s can counteract many of the effects of omega-6 fatty acids, so that anti-inflammatory compounds predominate in the body.<sup>18</sup> Suppressing inflammation may prevent many deleterious health effects, including cancer formation.

Comparing the effects of omega-3 to omega-6 fatty acid intake, scientists have noted lower cancer risks with higher omega-3 intake, and higher cancer risks with greater omega-6 intake.<sup>19,20</sup> Supplementing with moderate amounts of omega-3 fatty acids may thus be a sensible approach to tipping the scales away from cancer development.

## Omega-3s Fight Cancer in Laboratory and Animal Studies

Omega-3 fatty acids have shown impressive effects against laboratory models of cancer. Two of the most common of the omega-3 fatty acids, eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), have prevented the progression (continued growth) of breast and prostate cancer cells in both laboratory and animal studies.<sup>21,22</sup> Furthermore, omega-3 fatty acids appear to inhibit the appearance of receptors on the surface of cells that are needed for tumor cells to proliferate and spread (metastasize) to other tissues.<sup>4,23,24</sup>

Supplementation with omega-3 fatty acids may also help fight cancer by preventing angiogenesis, the formation of new blood vessels needed to fuel the growth of tumors.<sup>25</sup> Inhibiting angiogenesis can stop or slow the growth of cancer cells. Scientists believe that it is the anti-inflammatory effect of omega-3 fatty acids that enables them to prevent angiogenesis.<sup>26,27</sup> Although several pharmaceutical agents for fighting angiogenesis are currently under investigation, the dramatic influence of omega-3s in preventing angiogenesis, coupled with their excellent safety profile, could make them a first-line therapy in the fight against cancer proliferation.<sup>28</sup>



Scanning electron micrograph of human colon carcinoma, magnified 15,000 times.

## Omega-3s Show Potent Effects Against Prostate Cancer

Population studies suggest that dietary consumption of omega-3 fatty acids may have especially powerful effects in reducing the risk of

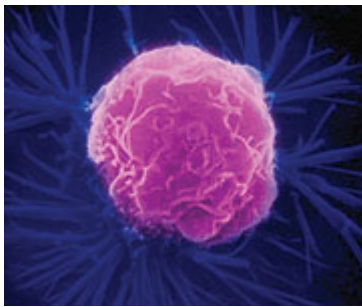
prostate cancer.<sup>29,30</sup> Furthermore, one study found that deaths from prostate cancer were lowest in populations that consumed higher quantities of foods containing omega-3 fatty acids.<sup>31</sup>

In an intriguing study published earlier this year, arachidonic acid, an omega-6 fatty acid, was found to increase the proliferation of malignant prostate cells, thereby increasing the risk of advanced prostate cancer. Remarkably, however, this effect was dramatically reversed by administration of the omega-3 fatty acid EPA.<sup>32</sup>

A notable study in animals showed that increased consumption of omega-3 fatty acids interfered with prostate tumor growth, while omega-6 consumption increased tumor growth. The research team found that omega-3s decreased the proliferation of cancer cells by causing them to naturally self destruct, or undergo apoptosis. Additionally, omega-3 fatty acids led to a decrease in prostate-specific antigen (PSA) doubling time, an important measure of disease progression and prognosis. In sum, these findings suggest that dietary consumption of omega-3 fatty acids may decrease the growth of prostate tumors and promote improved clinical outcomes.<sup>33</sup>

## **Omega-3s May Prevent and Inhibit Growth of Breast Cancer**

Omega-3 fatty acids likewise show promise in fighting deadly breast cancer. Population studies examining the relationship between diet and cancer have found that higher dietary omega-3 content is associated with a lower incidence of breast cancers in various populations.<sup>1,3,34</sup>



Scanning electron micrograph of a breast cancer cell, the most common form of cancer in women. The tumor starts in the breast and spreads quickly when not treated. If it is found during the very early stages, it can be surgically removed.

Studies in animals and in the laboratory provide clues to how omega-3 fats may help avert breast cancer. In an animal model of human breast cancer, animals consuming a diet rich in omega-3 fatty acids had a dramatic 40% increase in the activity of a natural cancer-suppressing biochemical compared to animals that consumed a diet rich in omega-6 fats. Furthermore, tumors from the omega-3-fed group expressed elevated levels of a gene that helps induce self destruction, or apoptosis, in cancer cells. When scientists applied EPA and DHA to breast cancer cells grown in the laboratory, their growth was inhibited by 20-25%, and the cells displayed physical characteristics suggestive of their imminent death.<sup>16</sup>

In the laboratory, omega-3 fatty acids have reduced the growth of breast cancer cells. Researchers noted that by regulating genes that are involved in cellular reproduction, the omega-3 fats prevented the cells from exhibiting the uncontrolled growth that characterizes cancer cells.<sup>35</sup>

Furthermore, omega-3 fatty acids suppress the appearance of a certain growth factor receptor on cells that is associated with poorer clinical outcomes from breast cancer.<sup>36</sup>

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## Omega-3s Shield Skin Against UV Light-Induced Cancer

Exposure to ultraviolet (UV) light contributes to several kinds of skin cancer. For more than a decade, scientists have known that omega-3 fats help reduce the skin's sensitivity to UV rays.<sup>37</sup>

Researchers recently discovered that omega-3s can help reduce the inflammatory skin response commonly known as sunburn, in part by lowering levels of an inflammatory prostaglandin. After adults supplemented with EPA for three months, they required much higher doses of UV radiation to redden their skin and did not experience the increased inflammation that usually follows sun exposure.<sup>38</sup>

A later study indicates that omega-3 fatty acids may reduce risk for skin cancer. In adults who supplemented with EPA daily for three months, omega-3 supplementation decreased the skin's susceptibility to sunburn and reduced by 50% the expression of a gene associated with UV light-induced skin cancer. In addition, the supplemented individuals had significantly fewer UV light-induced breaks in DNA strands.

EPA supplementation may thus help protect against UV-induced DNA damage that can lead to cancer, and long-term supplementation may help to reduce the risk of skin cancer in humans.<sup>39</sup>

## Omega-3s Enhance Effects of Cancer-Fighting Drugs

In the search for effective cancer-fighting regimens, scientists have explored the efficacy of combining omega-3 fatty acids with conventional pharmaceutical drugs. Exciting evidence suggests that omega-3s actually help to sensitize cancer cells to the effects of standard chemotherapy drugs. For example, researchers found that cancer cells with a higher concentration of DHA in their membranes were more susceptible to cell death from administration of the chemotherapy drug doxorubicin.<sup>40</sup>

Similar synergistic results were found when DHA was added to chemotherapy drugs in the taxane family, such as Taxol® and Taxotere®. Dramatic increases in tumor cell death occurred not only when DHA and the drug were administered together, but also when DHA was given before the drug. This suggests that DHA administration might help prepare patients for chemotherapy with taxane drugs, enhancing the drugs' efficacy in fighting cancer.<sup>41</sup>

### Omega-3s Inhibit Inflammatory Compounds

Hidden, imperceptible inflammation is now recognized for its role in triggering a chain of events leading to heart disease and other illnesses. Omega-3 fatty acids suppress multiple steps in this inflammatory process, inhibiting the production of inflammatory cytokines and prostaglandins. Furthermore, omega-3 fats boost production of anti-inflammatory compounds. These anti-inflammatory effects may have important implications for fighting heart disease and numerous other disease processes associated with excessive inflammation.<sup>10-16</sup>

An important marker of inflammation in the body known as C-reactive protein (CRP) is associated with an increased risk of cardiovascular disease. Measuring high-sensitivity CRP is an emerging method of detecting hidden inflammation and its associated cardiovascular disease risk.<sup>17</sup> Some scientists have observed that people who consume a greater amount of omega-3 fatty acids demonstrate lower levels of this cardiovascular risk factor, suggesting that omega-3 supplementation might help prevent cardiovascular disease by fighting inflammation.<sup>18</sup>

## Omega-3s Promote Healing From Cancer Surgery

Emerging research suggests that omega-3 fatty acids may help fight inflammation and prevent infection in individuals undergoing surgical treatment for cancer. Surgical treatment of any kind provokes a powerful, immediate inflammatory response, often coupled with immune suppression, which can lead to infections. Such inflammatory and immune challenges can drain the body's resources for recovery.<sup>5</sup> Omega-3 fatty acids may help support healing from cancer surgery.

Researchers have noted that omega-3 fatty acids reduce levels of inflammation while boosting beneficial immune responses, providing a "one-two punch" to suppress damaging post-operative inflammation and reduce the risk of post-operative infections.<sup>5</sup>

Omega-3 fatty acids may also be critically important for cancer patients who must undergo surgery.<sup>42</sup> Omega-3 supplementation has been associated with fewer complications of surgery, as well as with shorter hospital stays.<sup>43,44</sup> Because of the modest blood-thinning effects of omega-3 fatty acids, patients should consult with their surgeons before beginning supplementation.<sup>45</sup>

In one study, omega-3 fatty acids provided important benefits for patients who underwent surgery for intestinal cancers. Those who supplemented with omega-3 fatty acids before and after surgery experienced fewer complications and infections compared to patients who did not supplement. Additionally, the total costs of surgical treatment were substantially lower in the omega-3-supplemented group. Omega-3 fatty acids may thus help individuals to better tolerate surgical treatment of cancer.<sup>46</sup>



A similar study showed that patients who received omega-3 supplements before surgery for colorectal cancer demonstrated better immune responses and dramatically lower incidences of infection. Omega-3s thus helped promote rapid healing from surgery in cancer patients. This study may have broad implications for many types of patients undergoing surgery.<sup>47</sup>

## Conclusion

Of the many health benefits conferred by omega-3 fatty acids, their ability to prevent the development of cancer by quelling dangerous inflammation and promoting healthy gene expression may be among the most significant.

These essential fats likewise hold equal promise for those who are already battling cancer, as new findings suggest that omega-3s may exert cancer-fighting effects alone or in combination with pharmaceutical therapies. Omega-3 fatty acids may help to prevent infection and complications in people undergoing surgical treatment for cancer, and may help relieve one of the most devastating manifestations of cancer, the fatigue and weight loss known as cachexia.

While additional studies are needed, the research findings to date suggest that omega-3 fatty acids may play an important role in both preventing cancer and augmenting the effectiveness of existing anti-cancer therapies.

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