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Opinion

The Molecular Benefits of Exercise

Lauren Pecorino*

University of Greenwich, UK

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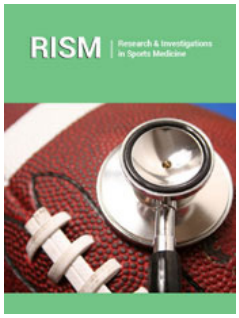

***Corresponding author:** Lauren Pecorino, University of Greenwich, UK

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Evidence of molecular mechanisms underlying the observation of physiological benefits provides additional impetus to adapt behaviour for well-being. This has been true for the long-observed cancer preventative correlations with diets rich in fruits and vegetables. Recent studies provided evidence that components in fruits and vegetables can turn on your detoxification genes, thus creating a mode of strong defense against incoming carcinogens [1]. The study of nutrigenomics, the effect of dietary constituents on gene expression, is expanding rapidly.

But the phrase we are all familiar with is "diet AND exercise".

Now the long-observed benefits of exercise are being supported by a growing body of evidence of resulting molecular changes that occur in cells. In relation to cancer, physical activity decreases the risk of many cancers and cancer mortality. Moore et al. (2016) reports the results of a large study of over a million participants that strongly supports the statement that physical activity decreases the risk of cancer. The effects of physical activity appear to be dose dependent with elite athletes having a 40% lower risk of overall cancer mortality compared to the general population. The following molecular mechanisms of physical activity are reviewed in Ruiz-Casado et al. [2] and Hojman et al. [3]. Exercise decreases specific circulating mitogenic hormones such as insulin growth factor one (IGF-1) and increases the activation of the central tumor suppressor protein, p53. It is also associated with increased levels of apoptosis, a type of cell suicide that is used to get rid of damaged cells that may lead to cancer. Moderate swimming increases dopamine levels and both moderate swimming and dopamine suppresses a cell transition, called EMT, which is important for cancer metastasis-the ability of tumor cells to spread throughout the body. There is also evidence that exercise affects innate immune cells such that cancer-promoting inflammation is decreased. Myokines, a range of molecules (e.g., SPARC) released into the bloodstream by skeletal muscle, now considered to be an endocrine organ, have emerging roles in the mechanism behind the anti-carcinogenic effects of exercise. Myokines such as SPARC (osteonectin) and IL-6 are linked to increased apoptosis in tumor cells and specific immune cells (e.g., natural killer) mobilization/infiltration respectively.

Exercise may lower basal systemic cancer risk factors, such as specific growth factors (e.g., IGF1), and increase several tumor-suppressive components during each event of exercise. This should provide additional motivation to follow The World Health Organisation recommendations of 150min/wek of moderate to vigorous Physical Activity (PA) (equal to at least the intensity of brisk walking). This is only the beginning of the birth of a new field. Large collaborative efforts are being formed to focus on these areas such as The Molecular Transducers of Physical Activity Consortium (MoTrPAC), which is funded by the National Institutes of Health (NIH) Common Fund.

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