

The Current State of Exercise-Induced Lymphocyte Apoptosis

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Abstract

Research into the area of exercise-induced lymphocyte apoptosis is a relatively new field of interest. The number of published manuscripts in PubMed peaked in the year 2005 and has been declining in recent years. Possible reasons for this decrease may be a lack of perceived relevance and some investigations that have questioned whether the phenomenon occurs. We proposed that continued study should be focused toward this issue as improvement in technology may allow for more sensitive measurement in the future. Finally, it is possible that this line of research may provide a mechanistic link between the benefits of exercise and a reduction in many chronic diseases that have been observed.

Keywords: Physical activity; Programmed cell death; Immune cells

Short Commentary

Research into exercise and the immune system is a relatively new field within the discipline of exercise physiology. Within this sub discipline, investigations specifically on the ability of exercise to induce lymphocyte apoptosis began with a report from Mars et al. in 1998 [1]. In that initial paper, evidence was provided that a single bout of exhaustive treadmill running in humans was sufficient to induce the cell death process termed apoptosis in the circulating lymphocyte population [1]. Since then various laboratories have reported that other modalities of exercise were also capable of inducing apoptosis in lymphocytes including cycling [2], tennis [3], and resistance training [4,5].

However, as more researchers began to investigate the ability of exercise to serve as a stimulus to induce apoptosis in lymphocytes, some authors began to question these findings, particularly in terms of its role in the post-exercise decrease in immune cell volume, termed lymphocytopenia [6,7]. In fact, two opposing views began to form: that exercise is capable of inducing lymphocyte apoptosis and does contribute to lymphocytopenia; and that exercise does not induce apoptosis and therefore plays no role in the decrease in circulating lymphocyte concentration observed following exercise. We have detailed potential reasons for the discrepancy between these two views [8] including differences in sampling time, no standardized methodology, and not accounting for various lymphocyte subsets.

A recent PubMed search through the US National Library of Medicine revealed that 96 articles have been published since 1998, peaking with 10 manuscripts in 2005 and showing a general trend to decline each successive year (Figure 1). The question that arises is whether or not research into exercise-induced lymphocyte apoptosis is still relevant, or was it a passing fad that has run its course. Only time will be able to provide the answer to this question, but we would like to provide an argument for continued investigation.

Lymphocyte cell death induced by exercise represents a relatively rare event when analyzed by flow cytometry, where percentages ranging from 1.3% [6] to 2.5% [9] are the standard. We have begun a paradigm shift in our analysis such that our recent investigations have reported absolute changes from rest and employ χ^2 testing against expected results [10,11]. This has allowed us to draw inferences that would have been missed through traditional forms of analysis. It is likely that as instrumentation advances through progress, researchers will have a greater

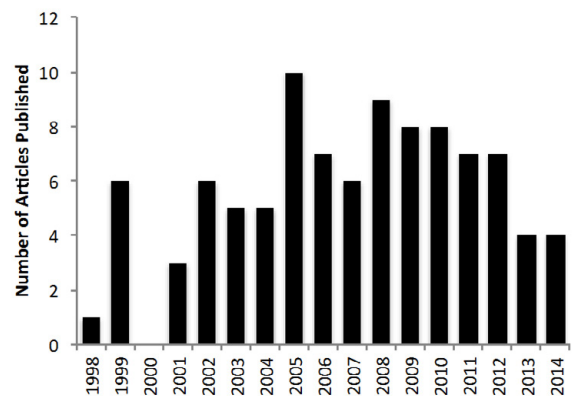


Figure 1: Number of PubMed published articles each year utilizing the key words: exercise lymphocyte apoptosis.

ability to measure rare events (such as exercise-induced lymphocyte apoptosis) through more sensitive equipment.

It is well established that exercise reduces the incidence of certain types of cancer including breast [12], and colorectal [13]. While no clear mechanism exists to explain this phenomenon, we would like to suggest that increased removal of potentially pre-oncogenic cells through a cell death mechanism induced by exercise should be considered. Obviously more research is needed to establish this connection, but is unlikely to occur if exercise-induced apoptosis studies continue to decline. In addition to the potential link between exercise and reductions in cancer incidence, it is possible that the benefits of exercise on other chronic diseases are also impacted by an apoptotic mechanism.

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In conclusion, while the research on exercise-induced lymphocyte apoptosis appears to be on the decline, we would like to express our view that it is a phenomenon with ample scientific evidence. As instrumentation and statistical techniques progress, these may allow for measurements that are specific and sensitive to the exercise and immunology arena. We propose that continued focus be placed in this area of inquiry as it has the potential to provide the link between the benefits of exercise and a reduction in various chronic diseases.

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