Regular physical activity is correlated with a reduced frequency of senescent T-lymphocytes in middle-aged men

Guillaume Spielmann[1, 2], Brian K. McFarlin[1], Paula J.W. Smith[2], Keith Guy[1, 2] and Richard J. Simpson[1, 2]

[1]Laboratory of Integrated Physiology, Department of Health and Human Performance, University of Houston, Houston, TX, 77204, USA.

[2]Biomedicine and Sports Science Research Group, Napier University, Edinburgh, EH10 5DT, UK

BACKGROUND: The clonal expansion of T-lymphocytes in response to an antigenic stimulus is an essential process of adaptive immunity. Chromosome telomeres become progressively eroded with each round of cell division, eventually leading to replicative senescence (1). T-lymphocytes with a senescent phenotype are known to accumulate with age, increasing infection risk in middle-aged and elderly individuals (2). A sedentary lifestyle is associated with shortened telomeres in peripheral blood leukocytes, but the influence of regular exercise on the frequency of T-cells with a senescent phenotype in young and older adults is not known.

PURPOSE: To examine the impact of estimated VO2max on the frequency of senescent blood T-cells in young and middle-aged men.

METHODS: Twenty young (Y; age: 23.4 ± 3; BMI: 24.6 ± 3) and 20 middle-aged (O; age: 54 ± 3.6; BMI: 26.4 ± 3.4) healthy males provided a fasted resting blood sample, completed an assessment of percentage body fat and a physical activity status questionnaire designed to estimate VO2max. Y and O subjects were then divided into Hi and Lo VO2max groups (VO2max; Y: 51.2 ± 4.4 vs 42.6 ± 2.2 ml·kg-1·min-1; O: 38.7 ± 3.3 vs 29.5 ± 1.3 ml·kg-1·min-1) with n=10 in each group. Isolated lymphocytes were assessed for cell surface expression of senescence (KLRG1+, CD28-, CD57+), naïve (CD45RA+) and memory (CD45RO+) T-cell markers on CD3+ T-cells, CD4+ T-cells and CD8+ T-cells using four-colour flow cytometry. Differences in T-cell phenotype among the 4-groups was analysed by one-way ANOVA.

RESULTS: O had a greater proportion of KLRG1+, CD57+, CD28-, KLRG1+/CD57+ and CD45RA-/CD45RO+ CD8+ T-cells than Y, regardless of estimated VO2max. No differences in senescent phenotypes were found between the Hi and Lo VO2max groups in Y. In contrast, the Hi VO2max group in O had a significantly lower frequency of CD4+ and CD8+ T-cells expressing KLRG1+ (CD4: 58%; CD8: 23% less), CD57+ (CD4: 71%; CD8: 20% less), CD28- (CD4: 91%; CD8: 24% less), KLRG1+/CD57+ (CD4: 89%; CD8: 26% less) and CD45RA-/CD45RO+ (CD4: 20% less), in comparison to the Lo VO2max group in O.

CONCLUSION: A higher estimated VO2max is associated with a lowered frequency of senescent and memory CD4+ and CD8+ T-cells in middle-aged but not younger men. These findings highlight the beneficial effects of regular physical activity on cellular immunity during ageing.

REFERENCES:

[1] Spaulding C., Guo W., Effros R.B. (1999) Resistance to apoptosis in human CD8+ T cells that reach replicative senescence after multiple rounds of antigen-specific proliferation. *Experimental gerontology*. **34**: 633-644.

[2] Vallejo A.N., Weyand C.M., Goronzy J.J. (2004). T-cell senescence: a culprit of immune abnormalities in chronic inflammation and persistent infection. *Trends in molecular medicine*. **10:** 119-124.