EFFECTS OF EXERCISE ON IMMUNE RESPONSES: INFLUENCE OF ROOM/AMBIENT TEMPERATURE ATHLETES

Dr. Ayu Suzailiana Muhamad
Exercise and Sports Science Programme,
School of Health Sciences,
Universiti Sains Malaysia,
16150 Kubang Kerian,
Kelantan, Malaysia.
E-mail: ayu_suzailiana@usm.my

Athletes and fitness enthusiasts are very concerned about the effects of exercise on immune function because cumulating evidence shows that impaired immune function may increase the risk of upper respiratory tract infection (URTI). It is well established that exercise-induced immune depression depends on the intensity and duration of exercise[1,2,3,4] where, in general, it has been demonstrated that regular moderate intensity exercise enhances immune function above those having sedentary lifestyle. While in contrast, prolonged exercise and periods of intensive training and competition may impair immune function[5]. Furthermore, the depression of immune function is most pronounced when the exercise is continuous, prolonged (> 1.5 h), of moderate to high intensity (55 – 75%), and performed without food intake[6].

In addition, exercising in hot conditions is associated with increased core temperature, cardiovascular drift, circulating stress hormones and catecholamine and increased reliance on carbohydrate as a fuel source[7,8]. Unsurprisingly, compared with thermo neutral conditions, endurance performance in the heat is impaired[7]. Previous study stated that there is an interaction between neuroendocrine and immune responses to exercise in the hot conditions, therefore, performing exercise in hot conditions with associated elevated circulating stress hormones and catecholamine would be expected to cause greater immune disturbance compared with exercise in thermo neutral conditions[9].

Exercise in cool condition is related with similar or slightly lower core temperature, muscle temperature and cardiac output and increased respiratory heat loss, ventilation[10], oxygen uptake[11] and carbohydrate oxidation[12,13]. A few studies have examined immune responses to exercise in cool conditions in human. These studies have mostly involved short-duration exercise protocols lasting < 1 h and have compared immune responses following exercise in cool conditions with immune responses in hot rather than thermo neutral conditions[14]. Nevertheless, although limited, the evidence to date does not support the popular belief that exercising in cool conditions suppresses the immune function.

Muhammad and colleagues[15] determine the effects of prolonged exercise in the hot (31°C) and cool (18°C) environments on salivary antimicrobial proteins, Immunoglobulin A (SIgA) and lysozyme responses, among recreational athletes. Thirteen healthy male participants (age: 20.9 ± 1.3 years old) were recruited and randomised in this cross-over study. Participants performed one exercise trial in the hot environment at 31°C first followed by another exercise trial in the cool environment at 18°C or vice versa with one week of recovery period. Physiological parameters (heart rate, ratings of perceived exertion, body weight changes and oxygen uptake) as well as room temperature and relative humidity were recorded. Cool water (3 ml.kg-1 body weight) was given to the participants at every 20 min during both exercise trials. Saliva samples were collected to calculate the saliva flow rate and analysed for SIgA and lysozyme concentrations and secretion rate. Paired t-test and two-way ANOVA with repeated measures were performed to analyse the data. This study found saliva flow rate, SIgA concentration, and secretion rate and lysozyme concentration and secretion rate did not significantly different between exercise trial in the hot and cool environments. However, within group effects showed that prolonged exercise significantly ($p<0.05$) decreased saliva flow rate and increased heart rate and ratings of perceived exertion in both trials. However, the values return to baseline 1 h post exercise. Salivary IgA and lysozyme were not significantly affected by prolonged running. As a conclusion, SIgA and lysozyme responses did not affected by ambient/room temperature. In addition, prolonged exercise with adequate fluid intake during exercise did not suppress salivary antimicrobial proteins which in turns may not increase risk of infection among athletes.

References:

1. Keast, D, Cameron, K & Morton, AR (1988). Exercise and the immune response. Sports Med, 5 (4), 248-267.
2. Mackinnon, LT (1989). Exercise and natural killer cells. What is the relationship? Sports Med, 7 (3), 141-149.
3. Gleeson, M & Bishop, NC (1999). Immunology. In RJ Maughan (ed.), Basic and Applied Sciences for Sports Medicine. Butterworth-Heinemann, Oxford, pp 199-236.

4. Gleeson, M, Bishop NC, Oliveira, M & Tauler, P (2011). Influence of training load on upper respiratory tract infection incidence and antigen-stimulated cytokine production. Scand JMed Sci Sports, 3 (67), 340-346.
5. Nieman, DC (1994). Exercise, upper respiratory tract infection, and the immune system. Med Sci Sports Exerc, 26, 128-139.
6. Gleeson, M (2006). Can nutrition limit exercise-induced immunodepression? Nutr. Rev, 64 (3), 119–131.
7. Galloway, SD & Maughan, RJ (1997). Effects of ambient temperature on the capacity to perform prolonged cycle exercise in man. Med Sci Sports Exerc, 29 (9), 1240-1249.
8. Febbraio, MA (2001). Alterations in energy metabolism during exercise and heat stress. Sports Med, 31, 47-59.
9. Hoffman-Goetz & Pedersen, BK (1994). Exercise and the immune system: a model of a stress response? Immunol Today, 15, 382-387.
10. Doubt, TJ (1991). Physiology of the exercise in the cold. Sports Med, 11, 367- 381.
11. Timmons, BA, Araujo, J & Thomas, TR (1995). Fat utilization enhanced by exercise in the cold environment. Med Sci Sports Exerc, 11, 1367-381.
12. Pitsiladis, YP & Maughan, RJ (1999). The effects of exercise and diet manipulation on the capacity to perform prolonged exercise in the heat and in the cold in trained humans. J Physiol, 517, 919-930.
13. Armstrong, LE (2000). Performing in extreme environments. Human Kinetics, pp 60-65.
14. Walsh, NP & Whitham, M (2006). Exercising in environmental extremes: a greater threat to immune function? Sports Med, 36 (11), 941-976.
15. Muhamad, AS, Chen, CK, Ayub, A & Ibrahim, NS (2016). Effects of Prolonged Exercise in the Heat and Cool Environments on Salivary Immunoglobulin A among Recreational Athletes. IOSR Journal of Sports and Physical Education (IOSR-JSPE), 3(4): 51-56.