



Autonomic and cardiovascular responses in flight and their relationship with physical fitness

Iransé Oliveira-Silva*
University Center of Anápolis-UniEVANGÉLIC

Director
Dr Daniel Alexandre Boullosa Alvarez
Universidade Católica de Brasília, Brazil

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Abstract

Flying is the most effective means of transportation available and is used by billions of people every year. However, the stressors present in air travel lead autonomic changes to occur, requiring the body to deal with them. Therefore, the preventive and/or mitigating strategies of these effects need to be understood. This study aims to evaluate the autonomic and cardiovascular responses that occur in flight and their relationship with physical fitness. The research was conducted through two studies in healthy men in whom the physical fitness components of aerobic capacity, muscular strength and body fat had previously been evaluated. Heart rate variability (HRV) was recorded on a control day and on a flight day. In the first study, HRV was recorded in 11 fighter pilots over a 3-h period and their level of dehydration during a test flight was measured through changes in hematocrit. The flight lasted 1 hour and they all underwent the same operating procedures. In the second study, HRV and blood pressure were recorded simultaneously over 24 h in 22 commercial airline passengers. The results of the study point to a reduction in most HRV parameters during supersonic flight compared to the control day. There is no autonomic anticipation. Entropy correlated with aerobic capacity and body fat. Flight-generated dehydration changed HRV (RMSSD and SD1). The second study demonstrates a reduction in most HRV parameters (RMSSD; SD1; SampEn; LnHF; $\alpha 1$) over 24 h in the commercial flight compared to the control day (FC; LnHF; $\alpha 2$). Autonomic anticipation took place. The blood pressure and Rate-Pressure Product were significantly higher in the flight, with the largest increases occurring two hours before the flight, and remaining elevated for up to two hours. The lower the body fat percentage and BMI, the greater the flight-day HRV (RMSSD; LF; HF; SD1). The higher the aerobic capacity, the greater the HRV during the flight (LnLF; LnHF). Conclusions: Flying, in both situations and groups, demanded autonomic responses of the body generating significant vagal withdrawal and an increase in heart rate. Body fat and aerobic capacity, indicators of physical fitness, correlated with HRV, albeit differently in both populations and situations: fighter pilots (SampEn) and commercial airline passengers (RMSSD; LF; HF; SD1). The dehydration generated by supersonic flight influences HRV. Blood pressure (SBP, DBP, MAP) is influenced by flight in the 24-h comparison. Autonomic changes correlate with aerobic capacity and body fat differently in supersonic jet pilots and commercial airline passengers during flight. Relative strength was not correlated with HRV parameters in either of the populations studied.

Keywords: physical fitness, flight, autonomic control

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***Corresponding author:**
Iransé Oliveira-Silva
iranse.silva@unievangelica.edu.br

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