Changes in the Salivary Biomarkers Induced by an Effort Test

Authors
V. N. de Oliveira¹, A. Bessa¹, R. P. M. S. Lamounier¹, M. G. de Santana¹, M. T. de Mello¹, F. S. Espindola¹

Affiliations
¹Universidade Federal de Uberlandia, Instituto de Genetica e Bioquimica, Uberlandia, Brazil
²Universidade Federal de Sao Paulo, Departamento de Psicobiologia, Sao Paulo, Brazil

Abstract
Physical exercise induces biochemical changes in the body that modify analytes in blood and saliva among other body fluids. This study analyzed the effect of an incremental effort test on the salivary protein profile to determine whether any specific protein is altered in response to such stress. We also measured thresholds of salivary alpha-amylase, total salivary protein and blood lactate and searched for correlations among them. Twelve male cyclists underwent a progressive test in which blood and saliva samples were collected simultaneously at each stage. The salivary total protein profile revealed that physical exercise primarily affects the polypeptide corresponding to salivary alpha-amylase, the concentration of which increased markedly during the test. We observed thresholds of salivary alpha-amylase (sAA), total salivary protein (PAT) and blood lactate (BLT) in 58%, 83% and 100% of our sample, respectively. Pearson’s correlation indicates a strong and significant association between sAA and BLT (r = 0.84, p < 0.05), sAA and PAT (r = 0.83, p < 0.05) and BLT and PAT (r = 0.90, p < 0.05). The increased expression of the salivary alpha-amylase (sAA) polypeptide suggests that sAA is the main protein responsible for the increase in total protein concentration of whole saliva. Therefore, monitoring total protein concentration is an efficient tool and an alternative noninvasive biochemical method for determining exercise intensity.

Introduction
Traditional biochemical approaches for studying individual proteins have provided structures and functions of a number of major salivary proteins. However, many salivary proteins and their functions remain uncharacterized [17]. Physical exercise induces biochemical changes in the body, which modify blood and saliva analytes among other body fluids [2,10,18]. Based on these observations, analyzing changes in the salivary protein profile may help to identify novel biomarkers for work load, recovery and injury. Measuring salivary analytes, such as total protein, alpha-amylase, electrolytes, lactate, cortisol and catecholamines may represent a noninvasive method to determine the relationship between intensity of exercise and the blood lactate threshold (BLT) [4,6,9]. The BLT is characterized by the transition from a linear to an exponential increase in blood lactate concentration, and its measurement has been of great use in both experimental and routine studies of physical performance [21,30]. Previous studies have shown that a salivary threshold exists beyond which a continuous increase in these analytes may serve as a salivary biomarker of exercise intensity [4,6,9]. Activity of the sympathetic nervous system increases progressively with intensity of exercise [32], altering some salivary components [3,10,38]. Bortolini et al. [4] investigated whether the total protein concentration of whole saliva (TPWS) reflects the anaerobic threshold during an incremental exercise test, and they observed a profound correlation between the total salivary protein threshold (PAT) and the BLT. Analysis of salivary proteins in rat parotid saliva revealed that the protein content in the parotid is markedly influenced by the type of stimulation (sympathetic or parasympathetic) used to induce secretion [1]. It has been proposed that salivary alpha-amylase (sAA) activity is regulated by the sympathetic-adrenal medullary (SAM) system through the action of norepinephrine on the salivary glands [8,34,40]. Activity of sAA increases in response...