Assessment of Total Plasma Macronutrient Contents By Fourier-transform Infrared Spectroscopy Following High-fat Diet and Exercise

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ABSTRACT

High fat-low carbohydrate (HFLC) diets are an increasingly common approach to enhancing overall health and performance in endurance runners. Total macronutrient contents in plasma may change in response to diet and exercise. **PURPOSE**: To examine the responses of total plasma macronutrient contents in trained males following dietary manipulation in combination with aerobic exercise. **METHODS**: Eight distance runners (age = 39.5±9.9 years, body weight = 81.6±7.1kg, height = 1.77±0.1m, and $V0_2max$ = 47.9±7.6 mL/kg/min) that typically consumed high-carbohydrate (HC) diets switched to a HFLC diet for 3 weeks. The caloric intake during the HFLC intervention derived from 70% fats with ≤ 50g of carbohydrates. Participants maintained normal fitness routines. Indoor treadmill exercise for 50 minutes at varying race paces followed by an outdoor 5-km time trial were completed during the HC and HFLC trials. Overnight fasting blood samples were collected before (baseline) and 24 hours after exercise to analyze changes in total plasma lipids, proteins, and carbohydrates using attenuated total reflectance Fourier-transform infrared spectroscopy (ATR FT-IR). The O-H stretch vibrational band of water was used to normalize the IR spectra of the plasma. Then the protein content was quantified by measuring the amide I peak intensity at 1600–1700 cm^{-1} which corresponded to the C=O stretch vibration mode. To quantify the lipids and carbohydrates, the plasma samples were lyophilized and measured at 2800–3000 cm^{-1}(C-H stretching vibration in acyl chains) and 800–1200 cm^{-1} (C-O-C vibration mode), respectively. **RESULTS**: The ATR FT-IR analysis found that, independent of diet or exercise, there were no significant changes in total plasma proteins (HC baseline=135.20±4.20, HC post-exercise=134.44±4.31, HFLC baseline=135.24±3.91, and HFLC post-exercise=135.93±2.52 AU). However, a significant accumulation of lipids (30.06±7.75 AU, 95% CI=6.93) and carbohydrates (42.92±11.62 AU, 95% CI=10.39) were observed at the HC baseline as compared to the HFLC baseline (28.29±7.56 and 38.47±13.08, respectively). In addition, total lipids in the HC diet significantly decreased at 24-hours post-exercise (from 30.06±7.75 to 28.51±7.91 AU, p=0.016). **CONCLUSION**: Amid the high carbohydrate diet, 24 hours post-exercise total lipid contents decreased, suggesting that lipids consumed as a primary energy substrate during exercise did not recover to baseline levels within 24 hours. Additionally, following the high carbohydrate diet, lipid and

carbohydrate contents had increased, possibly due to elevated plasma lipids resulting from decreased insulin sensitivity. In contrast, no significant changes occurred with the high fat diet.