

THE EFFECT OF EXERCISE AND DIET ON THE PHOSPHOLIPID MOLECULAR SPECIES PROFILE OF RAT SKELETAL MUSCLE: AN ESI- MS ANALYSIS

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Biological membranes separate cells from the external milieu and compartmentalise organelles within a cell, providing a specialised environment for many specific biochemical processes. Phospholipids are the major structural component of biological membranes, and as such have significant influence on their physical properties. Alterations in membrane phospholipid composition are known to influence a diverse range of cellular functions, from the properties of membrane-bound enzymes to cell growth.^{1,2} To date, our understanding of membrane lipid composition has been limited to phospholipid class or fatty acid analysis, primarily by thin layer chromatography (TLC), high performance liquid chromatography (HPLC) and gas chromatography (GC). Such techniques have revealed that the FA composition of skeletal muscle phospholipids is altered by diet and, to a lesser extent, by exercise training.³

Recent advances in the analysis of molecular species derived from biological sources through electrospray-ionization mass spectrometry (ESI-MS),^{4,5} provide us with the ability to rapidly screen for relative changes in phospholipid populations brought about by environmental factors such as diet or exercise.⁵ Accordingly, a comparative analysis of skeletal muscle phospholipid molecular species profile between oxidative and glycolytic rat skeletal muscle and the effect of exercise and diet on these profiles have been performed using ESI-MS. Female Sprague-Dawley rats were divided randomly into two diet groups: high carbohydrate (64 E% carbohydrate, 20 E% protein and 16 E% fat; n = 18) and high fat (0 E% carbohydrate, 21.9 E% protein and 78.1 E% fat; n = 18). They were further divided into three training groups: control, which performed no exercise training (n = 6); low intensity (8 m min⁻¹) treadmill running (n = 6); or high intensity (28 m min⁻¹) treadmill running (n = 6). All exercise-trained rats ran 1000 m session⁻¹, 4 days wk⁻¹ for 4 wks and were killed 48 h after the last training bout. We report a large and consistent level of membrane phospholipid rearrangement with both diet and exercise that is more extensive than has been reported using TLC, HPLC or GC. Even though little is known about the physiological or pathophysiological role of specific phospholipid molecular species in skeletal muscle it is likely that this remodeling will have an impact upon a range of cellular functions.

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