MM9733 A Comparison of Energy Efficiency in Individuals with Atherogenic Lipoprotein Profile versus Healthy Normolipidemic Individuals, or The Energy Efficiency Pilot Study

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Synopsis:
Hypotheses and Specific Aims: Individuals with atherogenic lipoprotein profile, also known as pattern B persons, will have decreased physical activity-associated energy expenditure compared to normolipidemic persons, or pattern A individuals. The specific aims of the study are as follows:

- To determine rates of energy expenditure associated with cycling activity of specific sub-maximal intensities of defined (15 minute) duration in pattern B versus pattern A persons
- To determine post-exercise energy expenditure in pattern B versus pattern A persons
- To determine total energy expenditure and the pattern of energy substrate partitioning (% CHO/% lipid oxidation) during and after exercise in pattern B versus pattern A persons

Background: Our studies have focused on a genetically influenced atherogenic lipoprotein phenotype (designated ALP or LDL pattern B) that predisposes to increased coronary disease risk as a consequence of a cluster of interrelated metabolic changes including increased levels of small dense LDL and triglyceride-rich lipoproteins, reduced HDL, and insulin resistance (Austin, et al. 1990; Reaven, et al. 1993). This trait is found in approximately 30% of men and 15% of postmenopausal women (Austin, et al. 1990; Austin, et al. 1993; Campos, et al. 1992). An increasing number of published studies have led to the widespread acceptance of the ALP phenotype as a major contributor to cardiovascular risk (Austin, et al. 1988; Gardner, et al. 1996; Lamarche, et al. 1997; Stampfer, et al. 1996).

The expression of the pattern B trait can be modulated by diet composition and weight loss (Krauss, et al. 2006). However, a small subset of individuals appears to be genetically "hard-wired" to exhibit pattern B irrespective of environmental influences. In our most recent studies, pattern B persons had increased body mass indices as well as body fat compared to their pattern A counterparts, differences that were retained even after weight loss was induced by caloric restriction (Siri and Krauss, unpublished data). Additionally, these pattern B individuals appeared to require greater caloric restriction in order to achieve the same amount of weight loss compared to pattern A persons. The latter observation suggests increased energy efficiency in pattern B persons, such that the utilization of energy is more tightly coupled to the performance of physical work compared to that in pattern A counterparts. That is to say, when performing the same physical task, pattern B persons may expend fewer calories than pattern A persons. Furthermore, energy expenditure and substrate utilization in the post-exercise or recovery period has been identified as an important component of total energy expenditure (Kuo, et al. 2005), and this may represent a point of divergence between pattern B and pattern A persons.

Certainly, in the context of evolution when periods of caloric abundance were followed by periods of caloric deprivation, increased energy efficiency, or the ability to store and retain energy, provided survival advantages. These advantages, however, become distinct disadvantages in an environment where food is abundant and the opportunity or necessity to be physically active is limited. An improved understanding of the intrinsic physiological differences between pattern B and pattern A persons may provide a basis for the prescription of appropriate dietary and lifestyle related therapies aimed at these subgroups. More aggressive dietary and exercise interventions may be required to reduce adiposity and suppress the atherogenic lipoprotein profile in individuals with pattern B.