Concurrent Session 18: Fatty Acids

The effect of lipids on skeletal muscle stress and inflammation

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Background – Metabolic inflammation has been recognised as a major underlying contributor to the pathogenesis of metabolic diseases. Excess circulating fatty acids (FA) are known to activate transcription factors involved in metabolic stress and inflammation, such as activating transcription factor (ATF)-2 and nuclear factor (NF)-κB. This activation ultimately triggers a biological response common to metabolic syndrome and obesity related disease. However, the composition of the FA (saturated (SFA) or unsaturated (UFA), level of intake (acute or chronic) and consequent impact on metabolic stress and inflammation is the subject of much speculation
Objective – To determine the impact of increased levels of circulating FA *in vivo* on markers of cellular stress (ATF-2) and inflammation (NF-κB) in skeletal muscle.
Design – Healthy adult subjects intravenously received either control (saline) or Intralipid infusion for 5 h. The FA composition of Intralipid was 18.7% SFA (primarily palmitic acid) and 81.3% UFA (primarily linoleic acid). Muscle biopsies were taken from the vastus lateralis before (pre) and immediately after the infusion (post). Phospho-p65 (Ser536) (NF-κB) and phospho-ATF-2 (Thr71) were measured by multisuspension array analysis (Bioplex 200, BioRad Laboratories Inc., CA, USA).
Outcomes – No change was observed for phospho-p65 (Ser536) or phospho-ATF-2 (Thr71); in either control (pre 22 ± 5, post 17 ± 1, P = 0.2) (pre 56 ± 35, post 46 ± 10, P = 0.646) or lipid infusion (pre 21 ± 4, post 22 ± 2, P = 0.545) (44 ± 12, post 42 ± 15, P = 0.724) respectively.
Conclusion – Contrary to our hypothesis, increasing the circulation of FA in healthy subjects for 5 h did not change the levels of phospho-p65 (Ser536) (NF-κB) and phospho-ATF-2 (Thr71) in skeletal muscle. This may have been due to the FA composition as SFA are known to activate these inflammatory pathways, whereas UFA may not. Additionally, exposure to increased levels of fatty acids for periods longer than 5 h may be necessary to induce a response. Therefore, infusion of a fatty acid emulsion does not elicit increased activation of key metabolic stress and inflammatory pathways in healthy human subjects.

Serum fatty acids are better predictors of serum total cholesterol concentrations when measured as molecular percentages rather than absolute concentrations

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Background – When serum fatty acids are analysed, each fatty acid can be measured as an absolute concentration, or more commonly, as a percentage of total fatty acids – molecular percentage. The ability of fatty acid biomarkers to predict disease risk may depend on the unit of measurement.
Objective – To determine whether serum cholesterol ester fatty acids expressed as concentrations or as molecular percentages are better predictors of serum cholesterol concentrations.
Design – Cross-sectional New Zealand National Nutrition Survey. Serum cholesterol ester fatty acids as well as serum cholesterol concentrations were analysed for 2393 participants, aged 15 or older.
Outcomes – The molecular percentage of serum cholesteryl linoleate was inversely associated with serum total cholesterol concentrations. Mean total cholesterol concentration was 0.17 mmol/L lower in participants ranked in the fifth quintile of serum cholesteryl linoleate compared with the first quintile (P=0.028, adjusted for sex, age, BMI, ethnicity, smoking status, and the interactions of sex and age, sex and bmi, and sex and ethnicity). The association was positive when cholesteryl linoleate was expressed as a concentration; participants in the fifth quintile had total cholesterol concentrations 0.29 mmol/L higher than the first quintile (P<0.001). Serum cholesteryl myristate, regardless of whether it was expressed as a molecular percentage or as a concentration, was positively associated with total cholesterol concentration.
Conclusion – Serum cholesteryl linoleate and myristate expressed as molecular percentages, but not as concentrations, predict total cholesterol in a manner which parallels the proven differential cholesterolaemic effects of these dietary fatty acids. These results suggest that fatty acid biomarker studies of lipoprotein-mediated cardiovascular disease risk should express fatty acids as molecular percentages rather than concentrations.