

Relationship of Soleus Muscle Intramyocellular lipid (IMCL) and C-reactive protein (CRP) levels in Healthy Asian Indian Males

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Objective: To investigate the relationship between intramyocellular lipid (IMCL) content of the soleus muscle of healthy Asian Indian males and C-reactive protein (CRP), a novel correlate of insulin resistance.

Introduction: Lipid accumulation in soleus muscle (IMCL) is closely related to glucose-insulin-lipid metabolism and insulin sensitivity. It is believed that deposition of IMCL represents an early abnormality in the pathogenesis of insulin resistance in Caucasians. However, skeletal muscle IMCL content and its correlates appear to be influenced by many factors including physical fitness, exercise and ethnicity. In the present study IMCL content of healthy Asian Indian males determined using in-vivo proton MRS was correlated with body mass index (BMI), measures of abdominal obesity, percentage of body fat (%BF), fasting and post-oral glucose load serum insulin levels and other surrogate markers of insulin resistance.

Methods: 30 healthy males (mean age = 40.6 ± 11.6 years) were investigated at 1.5T (Magnetom, Siemens). Spectra with and without water suppression from soleus muscle were obtained at TE = 135 ms and 270 ms using STEAM pulse sequence with TR = 3000 ms and number of scans = 32. Chemical shift are reported using water as the internal standard at 4.7 ppm. Contributions of IMCL and EMCL were estimated by deconvolution of the lipid resonance peak. The percentages of IMCL and EMCL with respect to water were calculated at a TE = 135ms by calculating the area under each peak. Oral glucose tolerance test was carried out to exclude type 2 diabetes mellitus. BMI, WHR, %BF were calculated for each subject. Serum insulin was estimated using 125I-insulin radioimmunoassay kit (Medicorp Inc., Canada). The homeostasis model assessment (HOMA) method was used for the calculation of insulin resistance. Measurement of high-sensitivity (hs) -CRP levels was carried out using an enzyme-linked immunosorbent assay kit (Biocheck Inc. USA). The normal hs-CRP concentrations using this assay ranges from 0.068 to 8.2 mg/l.

Results and Discussion: The median values of IMCL and EMCL were 9.6 (range 3.4–33.3) and 39.9 (range 8.9–101.7) of the intensity of the water resonance peak, respectively. IMCL content significantly correlated with age ($\rho = 0.64$, $p < 0.001$), BMI ($\rho = 0.41$, $p < 0.05$), %BF ($\rho = 0.53$, $p \leq 0.01$) and waist to hip ratio (WHR) ($\rho = 0.58$, $p < 0.01$). IMCL content was significantly higher if subjects had BMI = 25 kg/m² (17.7 ± 10.1 vs. 10.8 ± 5.3%, $p = 0.02$), %BF = 25 (15.5 ± 7.3 vs. 7.3 ± 2.8%, $p = 0.002$), and WHR = 0.95 (16.7 ± 7.2 vs. 10.6 ± 6.6%, $p = 0.03$). IMCL content did not correlate with values of insulin, HOMA-IR or CRP. Stepwise multiple linear regression analysis indicate that per unit increase in age and BMI would result in increasing IMCL content by 0.3 ($p < 0.01$) and 1.1 ($p < 0.01$), respectively. The absence of a relationship between IMCL and CRP indicates absence of correlation of IMCL with insulin sensitivity in Asian Indians, in contrast to white Caucasians matched for age and BMI [1]. It appears that skeletal muscle IMCL in Asian Indians is of less significance to glucose-insulin metabolism [2] and is not related to sub-clinical inflammation as compared to white Caucasians. Recent data show that physical activity may affect IMCL content [3]. When all the variables were simultaneously considered in a stepwise multiple linear regression analysis, age and BMI were significant factors for IMCL content. Finally, the IMCL-CRP relationship remains to be investigated in white Caucasians, Hispanics and other ethnic groups to determine the impact of ethnicity.

Conclusion: Soleus muscle IMCL content correlated significantly with measures of generalized and abdominal obesity but not with insulin sensitivity or CRP levels in healthy Asian Indian males. The current study indicates the absence of a relationship between insulin resistance and IMCL content.

References:

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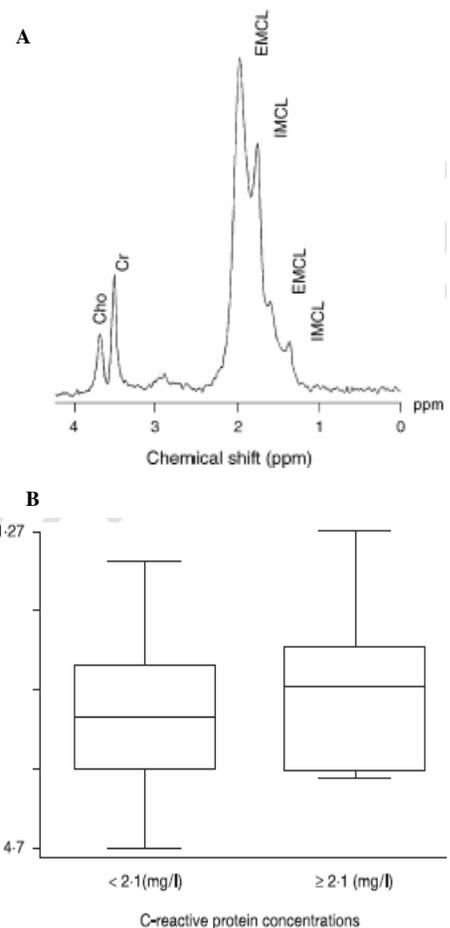


Fig.1 (A) Representative in-vivo ¹H MR spectrum of a healthy male acquired from soleus muscle at TE = 135 ms and TR = 3000 ms (B) Distribution of IMCL content according to C-reactive protein concentrations in healthy subjects.