Myocardial steatosis and its association with obesity and regional ventricular dysfunction: Evaluated by magnetic resonance tagging and 1H spectroscopy in healthy African Americans

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Introduction: Cardiac steatosis is reported to be common in patients with diabetes and obesity, and is implicated as a "predictor" of diastolic dysfunction in patients with type-2 diabetes mellitus. The exact mechanisms responsible for the development of cardiac steatosis and the factors associated with cardiac steatosis in humans are not fully understood. The objectives of this study were to explore demographical, physical, or laboratory factors that are independently associated with myocardial triglyceride contents in healthy individuals using Proton magnetic resonance spectroscopy (1H-MRS).

Materials and Methods: 109 healthy African Americans (AA) ≥ aged 21 years, without symptoms or clinical evidence of cardiac dysfunction or coronary artery disease were enrolled in the study. MRI studies were performed using Siemens 3.0T MR scanner. 1H-MRS was performed to noninvasively quantify myocardial triglyceride (TG) content. MR-tagged images were obtained in the short-axis plane at the mid-LV level for regional myocardial function. Univariate robust regression models were first fitted to evaluate the crude association between myocardial TG content and each of the factors—including age, sex, total serum cholesterol, HDL-cholesterol, LDL-cholesterol, serum triglycerides, high-sensitivity C-reactive protein (hsCRP), leptin, cigarette smoking, alcohol use, glucose level, systolic BP, diastolic BP, body mass index (BMI), and Framingham risk score, individually. Those factors that were significant at the $P<0.10$ level in the univariate models were put into the multivariate robust regression models to identify the ones independently associated with the presence of cardiac steatosis.

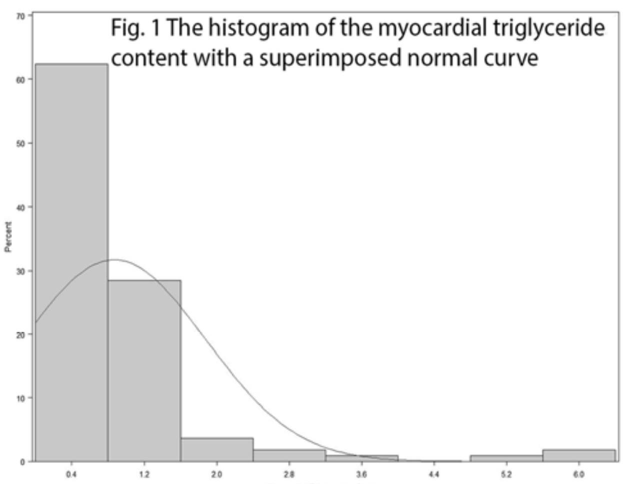

Fig. 1 The histogram of the myocardial triglyceride content with a superimposed normal curve

Results: Among these 109, 92 with a low Framingham risk and free of diabetes and hypertension (31 normal weight BMI<25, 23 overweight, and 38 obese, BMI≥30, median BMI was 27.7 kg/m^2) was included in the analysis. The median age (with IQR) was 37 (27-44) years. 41% were males. 62% were cigarette smokers, and 50% consumed alcohol. The distribution of myocardial triglyceride content was highly skewed (Fig.1). Fig.2 demonstrates myocardial TG levels by obesity status. Serum high-density lipoprotein cholesterol, hepatic triglyceride, and visceral fat were independently associated with myocardial TG content. These three factors explained 49% of variation in myocardial TG. BMI alone explained 43% of variation (Fig.3). For male participants, myocardial TG was not associated with regional strain. However, for female participants, myocardial TG was independently associated with regional strain.

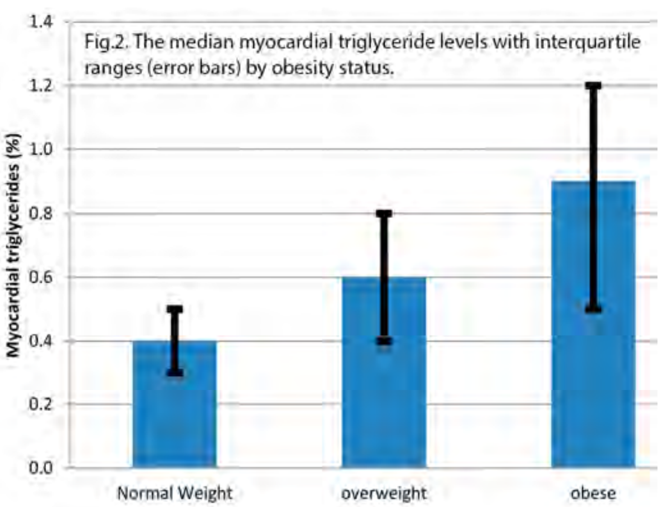

Fig.2. The median myocardial triglyceride levels with interquartile ranges (error bars) by obesity status.

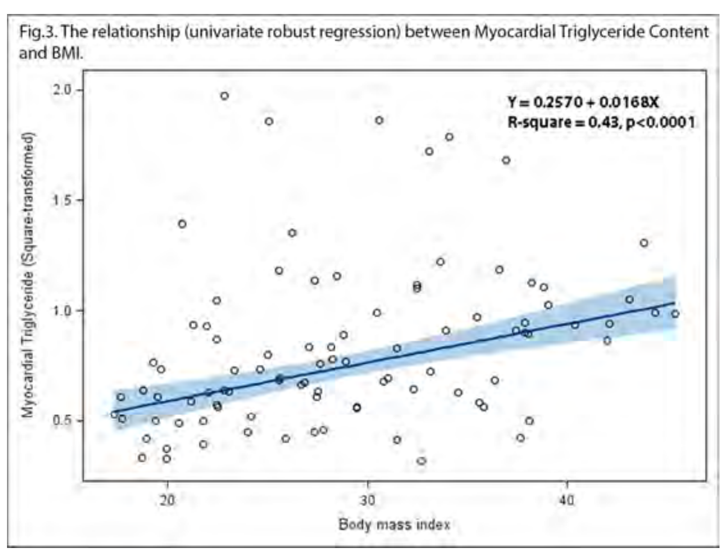

Fig.3. The relationship (univariate robust regression) between Myocardial Triglyceride Content and BMI.

Discussions: In healthy AA adults, obesity was shown to be associated with cardiac steatosis.