# Interethnic differences in fatty acid composition of deep subcutaneous abdominal adipose tissue

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**Introduction.** The study of fat distribution is important to understand the pathophysiology of obesity-related disorders, diabetes mellitus and cardiovascular diseases. Several studies have suggested that the fat distribution is different across different ethnic groups [1,2]. In addition to the analysis of fat distribution, the investigation of the fatty acid composition is also important because of their varying metabolic properties and association with insulin sensitivity [3,4]. Differences in the fatty acid composition induced by diet or ethnicity could potentially make some groups more susceptible to metabolic disorders. Studies have shown that the fatty acid composition of the different fat compartments vary between each other. Upper body subcutaneous fat is more saturated than the lower body subcutaneous fat and visceral fat is more saturated than the subcutaneous fat [5]. Deep subcutaneous adipose tissue (DSAT) is more saturated than the superficial subcutaneous adipose tissue (SSAT) and is also more lipolytically active [6]. Kokatnur et al. reported the ethnic differences in the fatty acid composition between black and white men [7]. In this study, we investigated the fatty acid composition in the abdominal deep subcutaneous adipose tissue of three ethnic groups (Chinese, Malays and Indians) non-invasively using magnetic resonance spectroscopy (MRS) approaches.

**Methods.** The study consisted of 205 healthy male adults (76 Chinese, 62 Malays and 67 Indians), aged 21 to 40 years with BMI 18 to 30 kg/m$^2$. Anthropometric measurements and metabolic profiles were obtained from all subjects. Insulin sensitivity index (ISI) was determined using hyperinsulinemic euglycemic glucose clamp. The spectrum from the adipose tissue was acquired from a 2 × 2 × 2 cm$^3$ voxel placed within the deep subcutaneous fat at the umbilicus level using PRESS sequence (TE/TR = 30/2000 ms, 24 avg) on a 3T MR scanner (Tim Trio, Siemens) (Fig. 1). The peak resonances were fitted and quantified using in-house developed Matlab program (Fig. 1). Each lipid resonance was fitted using a single Gaussian peak. The ratio of the olefinic peak (5.3 ppm) to the methyl peak (0.9 ppm) (unsaturation index, UI) is proportional to the average number of double bonds per fatty acid chain. The ratio of the diallylic peak (2.8 ppm) to the methyl peak (polyunsaturation index, PUI) is proportional to the fraction of polyunsaturated fatty acid content. The ratio of the n-methylene peak (1.3 ppm) to the methyl peak (saturation index, SI) gives a measure of the average number of n-methylene groups per fatty acid chain.

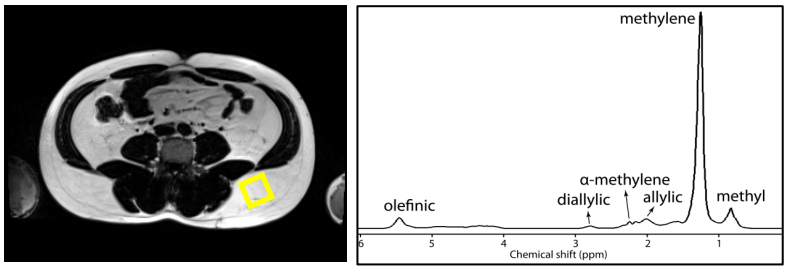


Fig. 1. MR spectrum obtained from the voxel (left) in DSAT

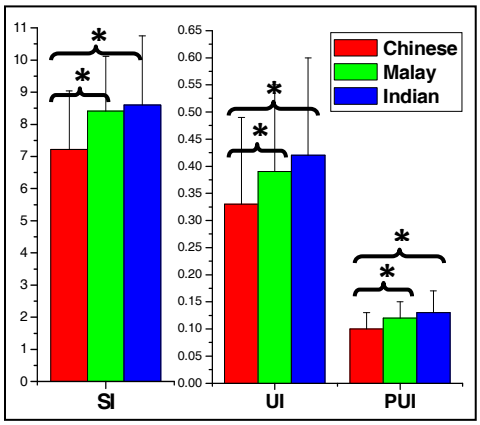


Fig. 2. Ethnic differences in fatty acid composition of adipose tissue (* p<0.05)

**Results.** Indians had the highest UI, PUI and SI among the ethnic groups followed by Malays and Chinese. One-way ANOVA analysis of the data from all the three groups showed that UI, PUI and SI were significantly different between the ethnicities. The source of polyunsaturated fats is the dietary intake and the difference explains the significant variation in the diets of the three groups. ISI was highest in Chinese and lowest in Indians. UI showed a significant negative correlation with insulin sensitivity in Chinese (r=-0.32, p<0.005) and Malay (r=-0.31, p<0.05). The unsaturation and saturation indices (UI, PUI and SI) of Chinese were significantly different from Malays and Indians. Malays and Indians had similar levels of UI, PUI and SI.

**Conclusion.** We have investigated the ethnic differences in the fatty acid composition of deep subcutaneous adipose tissue in Chinese, Malay and Indian men. PUI is strongly correlated to the poly unsaturated fat content in the diet, hence differences in PUI might be a marker for the ethnic differences in the dietary fatty acid composition. Monounsaturated and saturated fatty acids can be synthesized endogenously, hence the differences in UI and SI could potentially be modulated by both diet and ethnicity.

**References.** 1. Liska et al. PLoS ONE 2007; 2:e569. 2. Marshall et al. Obesity Research 2004; 12(8):1352-1359. 3. Roberts et al. Diabetologia 2009; 52(5):882-890. 4. Sjogren et al. Diabetolgia 2008; 51(2):328-335. 5. Seidelin. Prog. in lipid research 1995; 34(3):199-218. 6. Lundbom et al. Intl. Journal of Obesity 2012; 37(4):620-622. 7. Kokatnur et al. The American Journal of Clinical Nutrition 1979; 32:2198-2205.