Fat in the muscle leads to sugar in the blood

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It has become commonplace to think of type 2 diabetes as the metabolic manifestation of an insulin-resistant phenotype: characterised by increasing adiposity; associated with accelerated cardiovascular disease; and uncovered when the pancreatic beta-cells fail to respond to the increased insulin demand necessary to maintain normoglycaemia. The importance of fat and its distribution in controlling the metabolic mix-up is increasingly seen as critical, and we now readily recognise the importance of central, visceral adiposity as a dynamic endocrine organ orchestrating the process with a family of cytokine signals. Body fat and body fat distribution, are strongly genetically determined and acknowledged as significant risk factors for the development of type 2 diabetes.

Skeletal muscle also has an important role to play. It represents a large sink for glucose disposal (approximately 80% of glucose is disposed in human skeletal muscle) and a growing body of evidence points to a significant role for the accumulation of ectopic fat in skeletal muscle as an important cause of insulin resistance. What causes adipose tissue infiltration in skeletal muscle is, however, poorly understood and this interesting paper (Miljkovic-Gacic et al, 2008; summarised alongside) explores the differences in genetic and environmental contributions to ectopic adipose tissue accumulation in skeletal muscle using peripheral quantitative computed tomography (pQCT) in large multigenerational families of African-American people. pQTC involves scanning the calf muscle at its maximal density and calculating muscle density as mg/cm^3. It is a validated measure of adipose tissue infiltration; with reduced muscle density equating to more fat.

African-American people are particularly predisposed to develop obesity and diabetes and in many studies show higher levels of insulin resistance than those of other ethnicities across a wide range of age, BMI and glucose tolerance. This study involved a large number (n=471) of subjects from several generations of eight families. After adjusting for age and gender, no differences in BMI were observed between individuals with and without diabetes, but total adipose tissue and cross-sectional area of adipose tissue was greater, and the skeletal muscle was significantly less dense (more fatty) in those with diabetes. Residual heritability (additive genetic effects) were estimated to explain 35% of the variance in muscle density with significant covariates (age, BMI, gender and waist circumference) explaining the remainder of the differences between groups.

These results suggest that infiltration of adipose tissue into skeletal muscle is an inherited trait and is associated with diabetes, independent of overall obesity, BMI, and waist circumference. The search is on for the candidate genes and what interventions might reduce lipid deposition in muscle (particular exercise regimens or specific drug therapy) but in the meantime the message seems clear: fat in the muscle leads to sugar in the blood.

OBESITY

Fat in skeletal muscle is associated with diabetes

Readability	✓✓✓✓
Applicability to practice	✓✓✓✓
WOW! factor	✓✓✓✓✓

1 Diabetes is more prevalent in people of African descent. The authors of this study aimed to determine whether adipose tissue infiltration into muscle may account for differences in insulin sensitivity between ethnicities.

2 This study also assessed genetic and environmental factors leading to different muscle compositions and the association of these factors with the development of type 2 diabetes.

3 Peripheral quantitative computed tomography (pQCT) was used to measure skeletal muscle density in the calves of 471 individuals (60% women; mean age: 43 years).

4 Muscle tissue appears less dense using pQCT when more fat has infiltrated it.

5 Muscle density was found to be lower in people with diabetes (n=62; 69.5mg/cm^3) than people without diabetes (n=339; 74.3mg/cm^3; $P<0.001$).

6 Thirty-five per cent of variance in muscle density was due to additive genetic effects ($P<0.001$), and 55% of the total phenotypic variation in muscle density was caused by significant covariates (such as age, gender, BMI and parity)

7 After adjusting the data for age, gender, and BMI the difference was still significant ($P=0.005$). Significance also remained after adjusting for age, gender and waist circumference ($P=0.01$).

8 The results of this study provide new evidence to suggest that fat deposition in muscle tissue is associated with diabetes and is a heritable trait in families of African descent.

Miljkovic-Gacic I, Wang X, Kammerer CM et al (2008) Fat infiltration in muscle: New evidence for familial clustering and associations with diabetes. *Obesity* **16**: 1854–60

DIABETES CARE

Higher risk of pneumonia with diabetes

Readability	✓✓✓✓✓
Applicability to practice	✓✓✓✓
WOW! factor	✓✓✓

1 Diabetes may be a risk factor for pneumonia-related hospitalisation. This study attempted to confirm this.

2 A total of 34 239 people who had been admitted to hospital with pneumonia for the first time between 1997 and 2005 were included in the study.

3 For each one of the above people, 10 age- and sex-matched controls were selected from Denmark's Civil Registration System (n=342 390).

4 For participants with diabetes compared with those without, the adjusted relative risk (RR) for pneumonia-related hospitalisation was 1.26 (95% CI 1.21–1.31).

5 The RR for participants with diabetes whose HbA_{1c} was <7% compared with those without the condition was 1.22 (95% CI 1.41–1.30) and the RR for those with diabetes and an HbA_{1c} ≥9% compared with those without diabetes was 1.60 (95% CI 1.44–1.76).

6 Diabetes is a risk factor for pneumonia-related hospitalisation, and poor glycaemic control increases risk.

Kornum JB, Thomsen RW, Riis A et al (2008) Diabetes, glycaemic control, and risk of hospitalization with pneumonia. *Diabetes Care* **31**: 1541–5

DIABETIC MEDICINE

Women with type 2 diabetes more likely to develop depression

Readability	✓✓✓✓
Applicability to practice	✓✓✓✓✓
WOW! factor	✓✓✓

1 The prevalence and risk factors of depressive symptoms were studied in people with normal glucose metabolism (n=260), impaired glucose metabolism (n=164) or type 2 diabetes (n=124).

2 The Centre for Epidemiologic Studies Depression Scale was used to measure depressive symptom levels.

3 The prevalence of depressive symptoms in men with normal glucose metabolism was 7.7%, with impaired glucose metabolism was 7.0%, and with type 2 diabetes was 15.0%.

4 The prevalence of depressive symptoms in women with normal glucose metabolism was 7.7%, with impaired glucose metabolism was 23.1% and with type 2 diabetes was 19.7% (P<0.01).

5 Women with impaired glucose metabolism and type 2 diabetes are more likely to develop depression than men.

Adriaanse NM, Dekker JM, Heine RJ et al (2008) Symptoms of depression in people with impaired glucose metabolism or Type 2 diabetes mellitus: The Hoorn Study. *Diabetic Medicine* **25**: 843–9

DIABETES, OBESITY AND METABOLISM

Hypoglycaemia reduces treatment satisfaction and adherence

Readability	✓✓✓✓
Applicability to practice	✓✓✓✓✓
WOW! factor	✓✓✓✓

1 This observational, cross-sectional, multicentre study had three main aims: to evaluate factors associated with self-reported hypoglycaemia; to look at the links between self-reported hypoglycaemic symptoms and treatment satisfaction and barriers to treatment; to evaluate treatment satisfaction, adherence, and glycaemic control in people with type 2 diabetes on metformin who added a sulphonylurea or a thiazolidinedione to their treatment.

2 Seven countries were involved in the study (Finland, France, Germany, Norway, Poland, Spain and the UK) and 1709 people with type 2 diabetes met the inclusion criteria and were enrolled.

3 Data were collected by questionnaire from participants between June 2006 and February 2007. Data for glycaemic control were based on HbA_{1c} measurements in the prior year.

4 In participants with a history of macrovascular complications from diabetes and without regular physical activity, hypoglycaemia was significantly more likely.

5 Participants who reported hypoglycaemic symptoms had significantly lower treatment satisfaction scores ($P<0.0001$) and were significantly more likely to report barriers to adherence ($P=0.0057$) compared with those who had higher treatment satisfaction scores and who met target HbA_{1c} levels.

Álvaraz Guisasola F, Tofé Povedano S, Krishnarajah G et al (2008) Hypoglycaemic symptoms, treatment satisfaction, adherence and their associations with glycaemic goal in patients with type 2 diabetes mellitus: findings from the Real-Life Effectiveness and Care Patterns of Diabetes Management (RECAP-DM) Study. *Diabetes, Obesity and Metabolism* **10**: 25–32

DIABETES RESEARCH AND CLINICAL PRACTICE

Group discussion sessions improve glycaemic control

Readability	✓✓✓✓
Applicability to practice	✓✓✓✓
WOW! factor	✓✓✓✓

1 An intervention that focused on increasing participants' understanding of their condition to improve glycaemic control was carried out in people with type 2 diabetes. The results were compared with those of people with type 2 diabetes receiving standard care.

2 This article documents the 5-year follow-up data from this intervention.

3 The original study was carried out in 15 Swedish healthcare centres, and 104 people were randomised into control (n=60) or intervention groups (n=44).

4 The intervention group received 10 2-hour group sessions, which focused on the participants' questions and needs. The control group continued their visits to their GP and DSN (about one visit to each of them annually).

5 At baseline, mean HbA_{1c} in the intervention group was 5.71±0.76% (standard deviation), and in the control group was 5.78±0.71%.

6 Five-year follow-up mean HbA_{1c} remained 5.71±0.85% in the intervention group but increased to 7.08±1.71% in the control group. The adjusted difference in HbA_{1c} was 1.37% ($P<0.0001$).

7 The authors concluded that group sessions based on people's understanding of their diabetes are more effective at improving glycaemic control than conventional diabetes care.

Hornsten A, Stenlund H, Lundman B et al (2008) Improvements in HbA_{1c} remain after 5 years – a follow up of an educational intervention focusing on patients' personal understandings of type 2 diabetes. *Diabetes Research and Clinical Practice* **81**: 50–5