

# Discussed Posters

## SESSION 1: Abdominal obesity: lifestyle correlates

### THE LIPOMETER - A NEW OPTICAL DEVICE FOR PRECISE MEASUREMENT OF BODY FAT DISTRIBUTION AND RISK DETECTION

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Numerous international studies give evidence for a connection of typical types of body fat distribution and an increased risk for metabolic, cardiovascular, and endocrine disorders. The new optical device, Lipometer, developed at the Medical University of Graz, Austria, (European Patent EP: 0516251) opens a completely new scope and insight in human body composition. This tool permits the quick, non-invasive, and precise measurement of the thickness of subcutaneous adipose tissue (SAT-) layers at any given site of the human body. An individual Lipometer-SAT-Topography (SAT-Top) represents the result of measurements taken from fifteen anatomically well-defined body sites. Based on a dataset of measurements in more than 20.000 individuals aged between 7 and 80 years it is possible to describe healthy as well as pathological body fat distribution patterns of both males and females. In a special two-dimensional factorplot the measurements can be visualized for subjects or/and for groups; the SAT-Tops can be compared, and individual risks for getting certain diseases can be found. To use the SAT-Top for a body fat screening during diets, weight loss programs and for controlling the success of a treatment is possible. There are characteristic profile deformations in the case of metabolic and hormonal disorders (type2 diabetes, coronary heart disease, polycystic ovary syndrome). These persons have a more android body fat distributions with an excess of body fat in the upper part of the body and significantly thinner SAT layers on the legs. Factor analysis yields a new perspective on the risk profiles of the individual SAT-topography: patients with type 2 diabetes, coronary heart disease and polycystic ovary syndrome are found to be in same square of a two dimensional factor plot. However, thicker subcutaneous adipose tissue layers on the extremities also may exert as a protective effect on coronary heart disease and the fertile capability of a woman. Typical changes of body fat distribution correspond to specific disorders; hence, the Lipometry could provide a useful tool for early diagnosis and thus may be useful in prevention and therapy.

### OPTIMAL WAIST CIRCUMFERENCE REFERENCES FOR SCREENING CARDIOVASCULAR RISK FACTORS FOR CHINESE CHILDREN AND ADOLESCENTS

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**Objectives:** To explore the optimal threshold values of waist circumference (WC) for detecting cardiovascular (CV) risk factors for Chinese children and adolescent.

**Methods:** Association of WC and CV risk factors were studied among the data of 65898 children aged 7-18 years pooled from nine studies in China. CV risk factors in this study included hypertension (blood pressure above 95 percentile levels), dyslipidemia (having one or more of the next three: TG $\geq$ 1.7mmol/L, TC $\geq$ 5.18mmol/L, and HDLc $\leq$ 1.04 mmol/L) and elevated glucose level (fasting plasma glucose $\geq$ 5.6mmol/L). Receive-operating characteristic analysis (ROC) and logistic regression were employed to derive optimal age- and sex-specific waist circumference references for predicting CV risk factors.

**Results:** A slight increasing trend of CV risk factors was observed starting from the 75th percentile of waist circumference in the study population, while a remarkable increasing trend occurred from the 90th percentile. The optimal waist circumference thresholds for predicting high blood pressures were at the 75th percentile for both boys and girls, which was at the 90th percentiles for detecting at least two of the above three CV risk factors. Compared to children with waist circumference below the 75th percentile, the odds of having two CV risk factors doubled among children whose waist circumference being between the 75th and the 90th percentile, and increased by 5 times among children with waist circumference above the 90th percentile. The increasing trend of high blood pressure with waist circumference remained significant after stratified by BMI category.

**Conclusion:** The 75th and the 90th percentile of WC are the optimal cut-off points for predicting an increased and a substantially increased risk of CV factors for Chinese children and adolescents.

### COST OF ABDOMINAL OVERWEIGHT AND OBESITY IN AUSTRALIA

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**Objectives:** To estimate the health and non-health cost associated with abdominal overweight and obesity in Australia.

**Methods:** The Australian Diabetes, Obesity and Lifestyle study includes a longitudinal component with five year follow-up data collected in 2004/2005. Data were available on 6,218 participants aged  $\geq$  25 years at baseline. The direct health care cost, direct non-health care cost and government subsidies associated with waist circumference defined overweight and obesity were estimated using the 'bottom up' analytical approach.

**Result:** The annual direct cost per person increased from AU\$1,392 for people with normal waist circumference to AU\$1,879 for the abdominally overweight and AU\$2,828 for the abdominally obese. In 2005, the total direct cost in Australians aged  $\geq$  30 years was AU\$5.7 billion for the overweight and AU\$12.0 billion for the obese. Total direct costs were AU\$7.6 billion

more in the abdominally overweight and obese than those with normal waist circumference. Furthermore, these individuals received AU\$29.7 billion in government subsidies. Comparing costs by change in waist circumference status since 1999/2000, those who remained obese in 2004/2005 had the highest annual total direct cost (AU\$2,957). Cost was lower in overweight and obese people who reduced waist circumference (AU\$1,603 and AU\$2,469, respectively) compared with those who progressed to obesity (AU\$2,555) or remained obese.

**Conclusion:** The total direct cost of abdominal overweight and obesity in Australia is AU\$17.7 billion. The total direct excess cost due to abdominal overweight and obesity was AU\$7.6 billion. There is financial incentive at both individual and societal levels for those who are overweight or obese to reduce waist circumference.

#### BODY COMPOSITION IN METABOLICALLY HEALTHY OBESE AND NORMAL WEIGHT BUT METABOLICALLY OBESE PHENOTYPES IN A POPULATION SAMPLE

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**Aims:** Small studies suggest that the metabolically healthy obese (MHO) may have less visceral fat compared to insulin resistant obese subjects despite comparable total body fatness. Normal weight individuals with cardiometabolic risk factors, i.e., "metabolically-obese" normal weight (MONW) demonstrate higher abdominal adiposity compared to metabolically healthy normal weight subjects (MHNW). The aim of this study was to examine dual energy X-ray absorptiometry (DXA) measures of body composition in these subgroups derived from a population sample.

**Methods:** At follow-up (n=3206) of The North West Adelaide Health Study (n=4060 randomly selected adults, aged ≥18 years, recruited in 2000-2003), 1346 subjects aged ≥50 years with DXA measures and free of CVD were stratified by BMI (normal, overweight, obese) and the presence of metabolic obesity/risk: ≥2 metabolic risk factors [triglyceride ≥1.7mmol/l; HDL cholesterol males/females <1.0mmol/l, <1.3mmol/l respectively; blood pressure ≥130/85mmHg; fasting glucose ≥5.6mmol/l or self-reported diabetes; treatment for these disorders]. Clinic assessment included waist circumference (WC), and grip strength. Age and smoking adjusted means (SE) are reported. Statistical significance is p<0.05.

**Results:** In females (n=758), the MONW (n=62) had significantly increased levels of % total fat [35.5 (0.6) vs 32.9 (0.4)], and % trunk fat [37.4 (0.7) vs 32.9 (0.4)] but not WC compared with the MHNW (n=167). Despite no significant differences in total % fat, MHO (n=86) demonstrated significantly increased % leg fat [53.2 (0.7) vs 49.9 (0.5)], and reduced WC [101.1cm (0.8) vs 104.0 (0.6)] compared with the metabolically obese/at risk obese subjects (n=151).

In males (n=588), the MONW (n=38) also demonstrated significantly increased % total fat [23.8 (0.8) vs 21.0 (0.5)], % trunk fat [29.0 (1.3) vs 25.2 (0.7)] and a trend to lower leg fat free mass index compared with the MHNW (n=960). No significant differences between the MHO (n=44) and metabolically at risk obese subjects (n=118) were observed.

No differences in grip strength in MHO and MONW were observed.

**Conclusions:** Fat distribution plays an important role in these phenotypes and there is possibly a protective effect of reduced central but increased leg fat in maintaining metabolic health in obese females.

#### LONGITUDINAL OUTCOMES IN A COHORT STRATIFIED BY METABOLIC RISK AND BODY MASS INDEX

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**Aims:** Few studies have assessed longitudinal outcomes in metabolically healthy obese (MHO) or normal weight individuals with cardiometabolic risk factors, i.e., "metabolically-obese" normal weight (MONW). Our aims were to determine the correlates and longitudinal chronic disease risks associated with these phenotypes.

**Methods:** The North West Adelaide Health Study (mean follow-up time =3.5 years, SD=0.5) is a random population sample recruited in 2000-2003. Participants free of cardiovascular disease and not underweight (n=3743) were stratified at baseline by body mass index categories and the presence of metabolic obesity: ≥2 metabolic risk factors [triglyceride ≥1.7mmol/l; HDL cholesterol <1.0mmol/l (men), <1.3mmol/l (women); blood pressure ≥130/85mmHg; fasting glucose ≥5.6mmol/l or self-reported diabetes; or treatment for these disorders]. Outcome measures were incident diabetes (self-reported doctor-diagnosed or fasting glucose ≥7 mmol/litre; n=70), CVD (self-reported doctor-diagnosed myocardial infarction, angina, stroke; n=127), and metabolic obesity (n=332). Results are expressed as odds ratios (OR), 95% confidence intervals.

**Results:** The MHO (12.1%) demonstrated significant cross-sectional associations with middle age, neighbourhood disadvantage, former smoking, and low levels of alcohol use, physical activity and lung function when compared with the metabolically healthy normal weight. However, compared with the metabolically at risk obese, the MHO were significantly younger with normal and overweight waist circumference, engaged in moderate to high level physical activity and resided in high socioeconomic status (SES) areas. Longitudinally, MHO demonstrated increased risks of developing metabolic-obesity (OR=2.82, 2.0-4.0) and diabetes (OR=2.36, 0.8-7.1) but not CVD. Maintenance of metabolic health over time in the MHO was significantly associated with age ≤40 years (OR=2.83, 1.1-7.6), and at least moderate physical activity (OR=2.04, 1.01-4.1).

The MONW (4.1%) demonstrated significant cross-sectional associations with male gender, older age, central obesity, low household income and area level SES, current smoking, sedentarism, and increased longitudinal risks of incident cardiovascular disease/stroke events (OR=2.48, 1.1-5.4) and diabetes (OR=3.27, 0.9-12.1, p=0.07).

**Conclusion:** Both phenotypes experienced poor longitudinal health outcomes over a short time period. "Healthy" obesity was temporary. Identification of people with the MONW phenotype could prevent avoidable morbidity which may require less emphasis on BMI and increased surveillance of central obesity in primary care.

**COMPARISON OF THE EFFECTS OF A 3-YEAR LIFESTYLE MODIFICATION PROGRAM IN VISCERALLY OBESE MEN WITH IMPAIRED VS. NORMAL GLUCOSE TOLERANCE**

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Many studies have shown that impaired glucose tolerance (IGT) is another metabolic complication often associated with an excess of visceral adipose tissue. However, not every viscerally obese patient has IGT.

**Objective:** To compare the long term (3 years) effects of a lifestyle modification program in viscerally obese men with vs. without IGT.

**Methods:** Glucose tolerance status was assessed by a 75g oral glucose tolerance test and visceral adiposity was measured by computed tomography. A complete fasting plasma lipoprotein-lipid profile was also obtained in 83 viscerally obese men aged 30 to 65 years without diabetes followed for 3 years.

**Results:** Initially, 45 men were characterized by normal glucose tolerance (NGT) and 38 by IGT. After the 3-year intervention, men were classified into 4 groups on the basis of their initial and final glucose tolerance status [(NGT-NGT, n=32), (NGT-IGT, n=13), (IGT-NGT, n=20) and (IGT-IGT, n=18)]. Results showed that independently of their glucose tolerance status, men from all groups significantly improved their anthropometric and metabolic parameters in response to the intervention. However, comparison of these four groups revealed that NGT-IGT men were the group with the most substantial improvements in anthropometric parameters in response to the lifestyle modification program. NGT-IGT men represented the group with the smallest reductions in adiposity indices ( $\Delta$  BMI:  $-1.58 \pm 1.46$  vs.  $-0.54 \pm 2.15$  kg/m<sup>2</sup>, p=0.05,  $\Delta$  weight:  $-4.63 \pm 4.60$  vs.  $-1.49 \pm 6.24$  kg, p=0.05 and  $\Delta$  waist circumference:  $-6.42 \pm 4.49$  vs.  $-3.19 \pm 6.22$  cm, p=0.05, for NGT-NGT vs. NGT-IGT groups respectively). Moreover, NGT-NGT men were also characterized with the most substantial improvements in metabolic parameters such as HDL-cholesterol levels ( $\Delta$ :  $+0.20 \pm 0.19$  vs.  $+0.05 \pm 0.13$  vs.  $+0.08 \pm 0.16$  vs.  $+0.05 \pm 0.15$ , p< 0.02, for NGT-NGT, IGT-IGT, IGT-NGT and NGT-IGT groups respectively).

**Conclusion:** These results suggest that, irrespective of their glucose tolerance status, viscerally obese men significantly benefited from a 3-year lifestyle modification program even when they converted from NGT to IGT. However, viscerally obese men initially with NGT who remained NGT after the 3-year intervention represented the subgroup who benefited the most from the intervention.

**ABDOMINAL ADIPOSITY AND MORTALITY IN 3978 CHINESE OLDER ADULTS: A 6 YEARS FOLLOW-UP STUDY WITH DXA**

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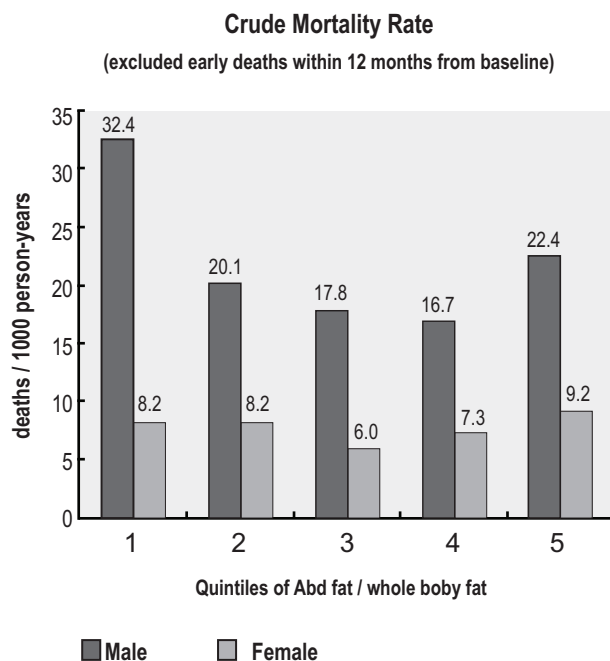
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**Background:** In contrast to that in the middle-aged, higher body mass index (BMI) is associated with higher survival rates in older people, which has led to the postulation that obesity might be less harmful or even protective in old age. Yet BMI is a measure of overall adiposity, which makes no distinction between fat elsewhere and abdominal fat, the latter being metabolically more harmful. We hypothesized that overall adiposity might be protective in old age, but that central fat might offset that benefit and remained harmful as in the middle-aged. We examine the relationship between abdominal adiposity and mortality in a cohort of older adults.

**Methods:** 3978 Chinese elderly  $\geq 65$  years were followed for 6 years. Demographics, medical conditions, physical activity, and body composition by DXA were recorded at baseline. Abdominal adiposity was measured according to specific anatomical landmarks and calculated as a proportion of whole body fat mass (relative abdominal fat = abd fat/whole body fat). Deaths within 1 year from baseline were excluded in analysis. Crude, all-cause, cardiovascular and cancer mortality were analyzed using Cox regression, adjusted for confounders. The lowest quintile of relative abdominal fat (RAF) was used as the comparison group.

**Results:** After a mean follow-up of 72.3(11.7) months, 271(13.7%) men and 90(4.5%) women had died. In men, the upper 4 quintiles of RAF was associated with a significantly lower HR for all-cause mortality (both crude and adjusted: HR(95% CI) in ascending quintiles compared with the lowest were 0.62 (0.43-0.89), 0.58 (0.4-0.85), 0.52 (0.36-0.77) and 0.67 (0.47-0.96). No significant relationship between abdominal adiposity and all-cause mortality for women was found. Neither was any significant relationship found for cardiovascular and cancer mortality in both genders.

**Conclusion:** Higher proportion of abdominal fat was associated with lower all-cause mortality in men. No such relation was found in women.



[Crude Mortality vs. relative abd fat quintiles]

### MRI DETERMINED ABDOMINAL ADIPOSITY CHANGES IN A COHORT OF BRITISH CHILDREN BETWEEN 11 AND 13 YEARS OF AGE

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**Objectives:** To examine the patterns of change in intra-abdominal adipose tissue (IAAT), subcutaneous abdominal adipose tissue (SAAT) and the IAAT/SAAT ratio over a two-year period in a sample of contemporary British children.

**Methods:** Magnetic resonance imaging (MRI) scans performed at L4-L5 were used to assess abdominal adiposity in a total of 78 children (50 boys and 28 girls) from the Avon Longitudinal Study of Parents and Children (ALSPAC) who volunteered to have an MRI scan at age 11.7±0.5 y (baseline) and who subsequently also volunteered to participate at age 13.7±0.5y (two-year follow-up). Stage of sexual maturation (at baseline) was assessed using a self-report questionnaire based on Tanner's criteria.

**Results:** There were no gender differences in IAAT (baseline: boys: 116.9 ± 98.1 cm<sup>3</sup>; girls: 171.9 ± 114.3cm<sup>3</sup>, P=0.873; follow-up: 171.9 ± 115.9 cm<sup>3</sup>; girls: 188.9 ± 136.2cm<sup>3</sup>, P=0.562) and SAAT (baseline: boys: 1104.8 ± 928.6 cm<sup>3</sup>; girls: 1311.5 ± 971.7cm<sup>3</sup>, P=0.357; follow-up: 1079.4 ± 948.5 cm<sup>3</sup>; girls: 1461.5 ± 955.6cm<sup>3</sup>, P=0.093) at either time point. However, there were gender differences in IAAT/SAAT ratio at baseline (boys: 0.13 ± 0.07; girls: 0.09 ± 0.05, P=0.043) and follow up (boys: 0.20 ± 0.10; girls: 0.14 ± 0.06, P=0.004). At both time points, boys showed higher IAAT/SAAT ratio compared with girls. Compare these two time points, there was significant mean change of IAAT/SAAT ratio both for boys (0.13 to 0.20, P < 0.001) and girls (0.09 to 0.14, P=0.004). Only boys showed significant mean change in IAAT (116.9 to 171.9cm<sup>3</sup>, P=0.008) but not for the girls (171.9 to 188.9 cm<sup>3</sup>, P= 0.068). There were no significant mean change in SAAT both for boys (P=0.887) and girls (P= 0.594) from 11 y to 13y.

**Conclusions:** From age 11 to 13years the development of IAAT and SAAT remains relatively small. The increase in IAAT/SAAT ratio, however, indicates the developing tendency towards greater relative visceral deposition, particularly in males, may be pre-emptive of subsequent health concern if such tendencies are found to continue into older adolescence and adulthood.

### TELEVISION VIEWING AND ABDOMINAL OBESITY IN WOMEN ACCORDING TO SMOKING STATUS: RESULTS FROM A LARGE CROSS-SECTIONAL POPULATION-BASED STUDY IN BRAZIL

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**Objectives:** To investigate the associations between television viewing and obesity in Brazilian women, according to smoking status.

**Methods:** The design comprised a cross-sectional household survey with probabilistic sample. Data of 14,987 adult women (18-49 years) from the 2006's National Demographic Health Survey were analyzed. Body Mass Index (BMI) was employed and individuals were classified as: adequate or low weight (BMI < 25 kg/m<sup>2</sup>); overweight (25.0-29.9 kg/m<sup>2</sup>) or obese (≥ 30 kg/m<sup>2</sup>). Waist Circumference (WC) was employed to measure abdominal obesity. Individuals were classified in three categories: WC < 80 cm (adequate); WC = 80.0-87.9 (level-1 risk); WC ≥ 88.0 cm (level-2 risk). The main co-variables were the frequency with which one watches television and habit of smoking. Frequency of television viewing was categorized as follows: every day, 5-6, 1-4 times per week, less than once a week and smoking status as smoker and non-smoker. Adjusted odds ratios were estimated using multinomial logistic regression.

**Results:** Prevalence of obesity was significantly higher among smokers who reported watching television 5-6 times per week compared to those who reported a lesser use (20.4 x 5.4%). Odds ratios adjusted by age, parity, skin color, and marital status showed that the chances of overweight and obesity are 2.5 (CI 95%: 1.1-5.7) and 11.7 (CI 95%: 1.5-89.1) more likely to occur, respectively, among smoking women who watch television 5 or more times per week, when compared to smoking women who watch television < 1 week. Smoking women who watch television 5 or more times per week presented a 3.5 greater chance of having level-1 abdominal obesity (CI 95%: 1.4-9.0) in relation to smoking women who watch television less than once a week. The chance of developing level-2 abdominal obesity among smoking women who watch television 5 or more times per week amounted to 2.4 times greater (CI 95%: 0.8- 7.0) in relation to the smoking women who watched television < 1 per week.

**Conclusions:** Watching television may increase the chance of overweight, obesity and abdominal obesity among women who smoke. More detailed information on media use, as hours per day, may offer better estimates.

### ARE COFFEE AND TEA CONSUMPTION ASSOCIATED WITH WAIST CIRCUMFERENCE?

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**Background:** Some studies have examined the influence of coffee and/ or tea consumption on obesity, but information regarding this association with abdominal obesity is scarce. The purpose of this study was to examine the associations between the frequency of coffee and tea consumption, and the use of additives in coffee and tea, with waist circumference. The potential association between coffee /tea and abdominal obesity is not trivial considering that more than 60% of the adult population drinks coffee/tea, that these beverages can be consumed as frequently as 10 times per day, and that a high percentage of coffee and tea drinkers use additives in these beverages.

**Methods:** A cross-sectional design was used. Participants consisted of 3823 men and women aged ≥18 years from the 2003-2004 U.S. National Health and Nutrition Examination Survey (NHANES). Waist circumference was measured at the level of the iliac crest using a flexible tape. Frequency of coffee and tea consumption and use of additives (sugar/honey, milk, cream or sweetener) for these beverages was assessed by questionnaire.

**Results:** The frequency of coffee consumption was not related to waist circumference in men or women once adjusted for covariates. However, men who frequently drank tea had smaller waist circumference values than men who were occasional tea drinkers ( $P \leq 0.05$ ) and men who never drink tea ( $P \leq 0.01$ ). No such pattern was observed in women. In men, the use of sugar as an additive was associated with a 2.52 cm lower waist circumference ( $P \leq 0.01$ ) and the use of artificial sweetener was associated with a 4.76 cm higher waist circumference. In women, the use of milk as an additive was associated with a 1.70 cm lower waist circumference ( $P = 0.03$ ) and the use of artificial sweetener was associated with a 2.37 cm higher waist circumference ( $P \leq 0.01$ ).

**Conclusion:** This study suggests that frequent consumption of tea ( $\geq 2$  cups/day) is associated with a lower waist circumference in men. The relationship between coffee and tea additives with waist circumference in men and women is intriguing and requires further study.

#### SWEETENED BEVERAGE CONSUMPTION AND INCREASED RISK OF METABOLIC SYNDROME IN MEXICAN ADULTS

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**Objective:** To examine the relationship between sweetened beverage consumption and components of metabolic syndrome in Mexican population.

**Methods:** We performed a cross-sectional analysis of data from adults participating in the baseline assessment of the Health Workers Cohort Study in the Mexican States of Morelos and Mexico. A total of 5,240 individuals aged 20 to 70 years (mean 39.4 years old; SD=11.5) were evaluated. Information on participants' socio-demographic conditions, dietary patterns and physical activity were collected via self-administered questionnaires. Sweetened beverage consumption was evaluated through a validated semi-quantitative food frequency questionnaire. Anthropometric and clinical measures were assessed with standardized procedures. The definition of metabolic syndrome was determined using criteria from Adult Treatment III. The associations of interest were evaluated by means of linear and logistic regression models.

**Results:** Overweight/obesity prevalence was 56.6%. The prevalence of metabolic syndrome in this sample was 26.6%. We found that for each additional daily sweetened beverage serving consumed, participants experienced an average increase of 0.49 mmol/L in triglycerides and a decrease of high density lipoprotein-cholesterol by 0.31 mmol/L. Subjects consuming more than two servings/day of sweetened beverage were at a 2.0 times greater risk of metabolic syndrome than those who did not consume sweetened beverage. We also observed that higher sweetened beverage consumption increases the risk of all metabolic syndrome's components.

**Conclusions:** Our data support the hypothesis that sweetened beverage consumption increases the risk of metabolic syndrome in Mexican adults, possibly by providing excessive calories and large amounts of rapidly absorbable sugars.

#### ABDOMINAL ADIPOSITY AND SLEEP PROBLEMS: ASSOCIATIONS IN A POPULATION-BASED SAMPLE OF OLDER ADULTS IN ENGLAND

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**Aims:** There is increasing interest in links between adiposity and sleep disturbance, and both have been related to cardiovascular disease, but few studies have examined associations in older adults.

**Methods:** We examined associations between abdominal obesity and self-reported sleep problems in 8843 adults from the English Longitudinal Study of Ageing (ELSA), who were aged 50+ at baseline, completed a nurse interview with measures of height, weight and waist circumference at baseline (Wave 0), and self-reported sleep problems at Wave 1 (mean 3 years later). The majority (n=6987) also reported sleep at the Wave 2 assessment (mean 5 years later). General obesity was defined as BMI  $\geq 30$  kg/m<sup>2</sup> and abdominal obesity as waist circumference  $\geq 102$  cm in men and  $\geq 88$  cm in women. Sleep problems were reported with a single item asking whether the respondent had experienced sleep disturbance over the past week. Covariates included smoking, limiting long-standing illness and financial status, all of which were associated with both poorer sleep and abdominal obesity.

**Results:** At Wave 0, obesity prevalence was 22.9% for men and 27.2% for women. Abdominal obesity prevalence was 37.8% for men and 44.9% for women. Self-reported disturbed sleep was reported by 34.8% of men and 45.5% of women in Wave 1, and 35.7% of men and 47.5% of men in Wave 2. Univariate analyses showed that sleep problems were significantly higher in those with abdominal adiposity in men (Wave 1: 38.7% vs 31.6%; Wave 2: 40.2% vs 32.5%) and women (Wave 1: 48.8% vs 41.3%; Wave 2: 53.1% vs 43.3%). Using multivariable logistic regression to control for age, gender and general obesity status, Wave 0 abdominal obesity predicted poor sleep in Wave 1 (OR=1.23, CI=1.09, 1.39) and Wave 2 (OR=1.35, CI=1.18, 1.54). Significant effects remained after additionally controlling for smoking, long-standing illness and wealth (Wave 1: OR=1.14, CI=1.01, 1.29; Wave 2: OR=1.25, CI=1.09, 1.44).

**Conclusions:** These results indicate that abdominal obesity is associated with poor sleep in older adults and that the effect is independent of general obesity or concurrent long-standing illness. Associations with poor sleep should be considered in understanding the pathological consequences of abdominal adiposity.

## SESSION 2:

## Abdominal obesity, adipokines, inflammation and ectopic fat

ADIPONECTIN ENHANCES *DE NOVO* HEPATIC HDL SYNTHESIS THROUGH LXR ALPHA- AND COUP-TFII-DEPENDENT PATHWAYS

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**Background:** HDL and apolipoprotein A-I (ApoA-I) take up cholesterol from peripheral tissues and transport it back to the liver, a system called "reverse cholesterol transport (RCT)". Both ApoA-I and ATP-binding cassette transporter A1 (ABCA1) are the rate-limiting factors that generate HDL in the liver. We for the first time identified adiponectin (APN) from adipocytes and have reported that it inhibits the development of atherosclerosis. We found a positive correlation between plasma HDL-C and APN concentrations in humans, and plasma APN is decreased in patients with coronary artery disease (CAD) and metabolic syndrome. We have shown that APN accelerates RCT by increasing the hepatic expression of ApoA-I and ABCA1. In the current study, we further evaluated the molecular mechanism of APN-induced enhancement of ApoA-I and ABCA1 expression by testing whether COUP-TFII, one of the orphan receptors, and LXR alpha are involved in this mechanism.

**Methods:** A human hepatoma cell line, HepG2 cells, were incubated for 20 h in the culture medium containing recombinant human APN after the incubation for 12 h with siRNA or control RNA for COUP-TFII or LXR alpha and the mRNA levels of ApoA-I and ABCA1 were measured by real time PCR.

**Results:** APN up-regulated the mRNA and protein levels of ApoA-I and ABCA1 in HepG2 cells. Furthermore, the expressions of COUP-TFII and LXR alpha were also significantly increased by APN, while these expression levels were significantly lower in APN-knockout compared with wild-type mice. In HepG2 cells, the reduction of COUP-TFII by siRNA reduced the APN-induced enhancement of ApoA-I but not ABCA1.

**Conclusions:** APN might protect against atherosclerosis by enhancing *de novo* hepatic HDL synthesis through both COUP-TFII- and LXR alpha-dependent pathways.

## ADIPONECTIN IN CHRONIC KIDNEY DISEASE: THE ROLE OF RENAL FUNCTION AND INTRA-ABDOMINAL FAT

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**Background:** Adiponectin is an adipose tissue-derived protein that carries antiatherogenic properties. Paradoxically, the increase in body fat has been associated with reduced circulating levels of this adipokine. On the other hand, the loss of renal function results in accumulation of serum adiponectin. In fact, studies show that adiponectin is elevated among patients with chronic kidney disease (CKD); however, the cardiovascular complications remain the main cause of mortality in these patients accounting for more than half of death rate. Therefore, to explore the role of adiposity on adiponectin levels, an issue scarcely investigated in CKD, is of relevant importance for this population.

**Aim:** This study aimed to evaluate the influence of body fat distribution and renal function on the adiponectin levels in nondialyzed CKD patients.

**Methods:** We prospectively evaluated 98 patients with CKD [glomerular filtration rate (GFR) 36.1±14.4ml/min, 56.5±10.4y, 63% male, 31% diabetics, and BMI 27.1±5.2kg/m<sup>2</sup>]. Total body fat was assessed by dual X-ray energy absorptiometry. Visceral and subcutaneous abdominal fat areas were measured by computed tomography at the L4-L5 level. Adiponectin concentrations were measured in fasting serum samples by ELISA. Estimated GFR and proteinuria were used as markers of renal function.

**Results:** Adiponectin correlated with GFR ( $r=-0.45$ ;  $P<0.001$ ), proteinuria ( $r=0.21$ ;  $P=0.04$ ), BMI ( $r=-0.33$ ;  $P<0.01$ ), and visceral fat ( $r=-0.49$ ;  $P<0.001$ ). In the linear regression analysis, the determinants of adiponectin levels were gender (female) ( $\beta=3.8$ ;  $P<0.01$ ), age ( $\beta=0.14$ ;  $P=0.03$ ), GFR ( $\beta=-0.15$ ;  $P<0.01$ ) and visceral fat ( $\beta=-0.04$ ;  $P<0.001$ ) ( $R^2=0.41$ ). After 12 months, a progression of the disease was evidenced by reduction of GFR ( $-1.6\pm 6.3$ ml/min;  $P=0.01$ ) and increase of proteinuria ( $0.3\pm 0.8$ g/d;  $P<0.01$ ). An accumulation of visceral fat was observed, from  $98\pm 73$ cm<sup>2</sup> to  $111\pm 82$ cm<sup>2</sup> ( $P<0.001$ ), with a concomitant reduction of adiponectin concentration, from  $27.6\pm 7.5$ mg/l to  $22.2\pm 11.6$ mg/l ( $P<0.001$ ). Body weight, BMI, total body fat, and subcutaneous abdominal fat remained unchanged. Adjusting for the baseline determinants of adiponectin, changes in visceral fat ( $\beta=-0.04$ ;  $P=0.025$ ) and not changes in GFR or proteinuria were associated with the changes in adiponectin during the follow-up.

**Conclusion:** Intra-abdominal fat as well as renal function were independent determinants of adiponectin in CKD patients. However, overtime changes in adiponectin levels were best explained by the changes in intra-abdominal fat.

**TOTAL AND HIGH MOLECULAR WEIGHT ADIPONECTIN IN VISCERAL OBESITY: IMPACT ON HDL CHOLESTEROL LEVELS AND ON GLUCOSE-INSULIN HOMEOSTASIS**

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We have previously reported that total adiponectin concentration predicted glucose tolerance and HDL cholesterol levels in a manner which is partly independent from the contribution of visceral adiposity. However, whether the high molecular weight (HMW) form of adiponectin is also a predictive marker of these cardiometabolic risk (CMR) variables beyond visceral adiposity is still unclear.

**Objective:** To examine the associations between total and HMW adiponectin levels with several CMR variables in a sample of 231 men.

**Methods:** Subjects underwent a 75g oral glucose tolerance test.

**Results:** Plasma levels of total, HMW adiponectin and ratio HMW/total adiponectin showed significant correlations with several CMR indices.

	Total Adiponectin	HMW Adiponectin	Ratio HMW/Total Adiponectin
Visceral adipose tissue	r=-0.19, p=0.003	r=-0.21, p=0.002	NS
HDL cholesterol	r=0.30, p<0.0001	r=0.36, p<0.0001	r=0.26, p<0.0001
Chol/HDL cholesterol	r=-0.20, p=0.002	r=-0.25, p<0.0001	r=-0.13, p=0.04
Fasting insulin	r=-0.26, p<0.0001	r=-0.29, p<0.0001	r=-0.17, p=0.01
AUC insulin	r=-0.20, p=0.002	r=-0.21, p=0.001	NS
AUC glucose	r=-0.18, p=0.006	r=-0.24, p=0.0002	r=-0.14, p=0.03

[Correlations between adiponectin and CMR variables]

When men were classified into tertiles of visceral adipose tissue and further classified on the basis of the 50<sup>th</sup> percentile of total adiponectin levels ( $\leq$  vs.  $>$ 7.5ug/ml), HMW adiponectin levels ( $\leq$  vs.  $>$ 1.2ug/ml) or the ratio of HMW/total adiponectin, a 3X2 ANOVA revealed an independent contribution of total and HMW adiponectin on the variation of both HDL cholesterol levels ( $p < 0.0001$ ), and of the glucose area ( $p < 0.01$ ) whereas the ratio HMW/total adiponectin only predicted HDL cholesterol levels ( $p < 0.002$ ). Moreover, total and HMW adiponectin also predicted fasting insulin levels ( $p < 0.01$ ) and AUC of insulin ( $p < 0.02$ ).

**Conclusions:** These results support the notion that total adiponectin as well as the specific HMW isoform are significantly related to several CMR variables and even predict HDL cholesterol levels as well as glucose tolerance and insulin sensitivity, beyond the contribution of visceral adiposity. As both total and HMW adiponectin levels were related to HDL cholesterol levels and to glucose-insulin homeostasis, these results stress the importance of this adipokine as a potentially protective factor for type 2 diabetes and CVD.

**ASSOCIATIONS OF WAIST CIRCUMFERENCE WITH PROFILE OF INFLAMMATORY FACTORS AND ADIPOKINES AMONG MIDDLE-AGED AND OLDER CHINESE PEOPLE**

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**Objectives:** To investigate the association between waist circumference and profile of inflammatory factors and adipokines, and the modifying effects of physical activity on the association.

**Methods:** 3289 Chinese (1458 men and 1831 women) aged 50-70 years participated in a cross-sectional survey. Plasma concentrations of high-sensitive C-reactive protein (hsCRP), interleukin 6 (IL-6), tumor necrosis factor- $\alpha$ receptor 2 (TNF- $\alpha$ R2), adiponectin and retinol-binding protein 4 (RBP4) were measured. Levels of total physical activity were assessed with a standardized questionnaire. Abdominal obesity was defined as waist circumference  $\geq$  90 cm for men and  $\geq$  80 cm for women. Inflammation and adipokine indices were constructed with combined z-scores, respectively.

**Results:** An increment of every 2 cm of waist circumference in men was associated with increased levels of hsCRP, IL-6 and RBP4 by 0.033 mg/L (95% confidence interval [CI]: 0.019, 0.048), 0.027 ng/L (95% CI: 0.012, 0.042), and 0.801 mg/L (95% CI: 0.536, 1.065), and reduced plasma adiponectin by 0.308 mg/L (95% CI: -0.497, -0.118), respectively; while the increment in women was associated with higher levels of hsCRP, IL-6, TNF- $\alpha$ R2 and RBP4 by 0.038 mg/L (95% CI: 0.026, 0.050), 0.017 ng/L (95% CI: 0.006, 0.029), 15.570 ng/L (95% CI: 4.573, 26.566) and 0.451 mg/L (95% CI: 0.256, 0.645), and declined adiponectin by 0.209 mg/L (95% CI: -0.405, -0.013), respectively, after adjustment for age, investigation site, education, smoking, alcohol drinking, physical activity, BMI, CHD, stroke, diabetes, family history of CVD and diabetes and using medications of anti-hypertension, aspirin, and antibiotics. Each a 1-SD increment in total MET-hour/week was associated with a 0.45 cm (95% CI: -0.66, -0.24) decrease in waist circumference in men and a 0.32 cm (95% CI: -0.60, -0.04) in women, respectively. In the joint multivariable analyses, the significant association between high levels of physical activity and lower values of inflammation and adipokine indices (all  $P < 0.0001$ ) was only observed among those without abdominal obesity.

**Conclusions:** Increased waist circumference is associated with a worse profile of inflammatory factors and adipokines in Chinese. Whether the association between high levels of physical activity and the improved profile is mediated via the decreased waist circumference warrants further investigation.



### ADIPOSE TISSUE-CONDITIONED MEDIA REVEALS THE ROLE OF ADIPOKINES IN MEDIATING FAT DEPOT-SPECIFIC EFFECTS ON INSULIN SENSITIVITY IN SKELETAL MUSCLE

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**Aims:** To determine the effect of secretory factors from subcutaneous and visceral fat on insulin-stimulated glucose uptake in skeletal muscle cells and the mechanisms involved.

**Methods:** Adipose tissue-conditioned medium (CM) was obtained by incubating subcutaneous (SC) and visceral (IAB) adipose tissue explants from obese humans (n = 4) in cell culture medium. The concentrations of long-chain fatty acids (LCFAs) and cytokines (leptin, adiponectin, interleukin (IL)-6, IL-8, IL-1 $\beta$ , tumor necrosis factor (TNF)- $\alpha$ , resistin and plasminogen activator inhibitor (PAI)-1) in CM were determined using gas chromatography and a Human Adipocyte Linoplex kit respectively. L6 myotubes were cultured with CM for 6 hours and insulin-stimulated glucose uptake was measured.

**Results:** The concentration of total LCFAs in CM from SC fat as compared to IAB fat was 1.8-fold ( $P = 0.05$ ) higher. The difference was mainly contributed by *cis*-9 oleic acid, which was 2.4-fold ( $P < 0.01$ ) more abundant in CM from SC fat. IL-6 and IL-8 in CM from IAB compared to SC fat were 15-fold ( $P < 0.05$ ) and 8-fold ( $P < 0.05$ ) higher respectively. In CM from IAB as compared to SC fat, the concentration of adiponectin (75%;  $P = 0.13$ ) was lower while those of TNF- $\alpha$  (320%;  $P = 0.11$ ), resistin (223%;  $P = 0.13$ ) and PAI-1 (153%;  $P = 0.07$ ) were higher.

In L6 myotubes, CM from IAB fat reduced insulin-stimulated glucose uptake by up to 19% ( $P < 0.05$ ), an effect that was completely restored by inhibiting the activation of either nuclear factor kappa B (NF $\kappa$ B) or the mammalian target of rapamycin complex 1 (mTORC1). Neutralisation of IL-6 in CM from IAB fat using an anti-IL-6 antibody restored insulin-stimulated glucose uptake to 65% of the controls. IL-6 at concentrations comparable to that in CM from IAB fat inhibited insulin-stimulated glucose uptake in a dose-dependent manner by ~30% ( $P < 0.001$ ), an effect reversed by anti-IL-6 antibody.

**Conclusions:** Secretory factors from IAB but not SC fat impair insulin sensitivity in skeletal muscle via the activation of a NF $\kappa$ B/mTORC1-dependent pathway. The effect of IAB fat is partly mediated by IL-6 and the mechanisms involved are currently under investigation.

### SCREENING FOR METABOLIC SYNDROME IN THE GENERAL POPULATION BY USE OF HS-CRP AND A TAPE MEASURE

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**Aims:** High-sensitivity C-reactive protein (hs-CRP) is an independent marker of the occurrence of type 2 diabetes and cardiovascular disease and is also associated with the metabolic syndrome (MetS) and its separate components.

Early diagnosis of the MetS is desirable because adequate treatment of the risk factors associated with the MetS can prevent cardiovascular disease. With the availability of a valid point of care test for hs-CRP, this measurement would be quick and easy to perform. We assessed whether measurement of hs-CRP can be used to detect the metabolic syndrome in a non-selected, apparently healthy general population. We assessed associations between hs-CRP and the individual components of the MetS and evaluated whether hs-CRP, alone or in combination with waist circumference, can predict the presence of the MetS.

**Methods:** In 1860 individuals - aged 20-70 years and not known with diabetes, hypertension or dyslipidemia - anthropometric parameters and venous blood samples were obtained and a questionnaire was completed. MetS was defined according to the NCEP/ATP III-criteria. Hs-CRP was divided into three risk level categories: < 1 mg/L (low risk of cardiovascular disease), 1-3 mg/L (intermediate risk) and 3-10 mg/L (high risk). The associations between hs-CRP and the different MetS components were assessed by logistic regression analysis. The areas under the ROC curves (AUC) were calculated, for hs-CRP alone and in combination with waist circumference.

**Results:** 1752 participants had hs-CRP levels below 10 mg/L and were included in the analyses. 433 of these had MetS. In individuals with MetS median hs-CRP was 2.10 mg/L (IQR 1.20-4.00), compared to 1.40 mg/L (IQR 0.80-2.90) in individuals without MetS ( $p < 0.001$ ). A linear trend was seen between the hs-CRP categories for all MetS components. Age (B -0.005), gender (B 0.630), waist circumference (B 0.027), triglycerides (B 0.255), systolic blood pressure (B 0.004) and current smoking (B -0.210) were independently associated with hs-CRP ( $R^2 = 16.8\%$ ). The AUC for hs-CRP alone was 0.620 (95%-CI 0.591-0.650) and for hs-CRP combined with waist circumference 0.786 (95%-CI 0.763-0.809).

**Conclusions:** In an apparently healthy, general population hs-CRP, combined with waist circumference, might be a useful screening tool for detecting MetS.

### ABDOMINAL ADIPOSITY AND SOCIOECONOMIC STATUS AS DETERMINANTS OF CARDIOVASCULAR, INFLAMMATORY AND NEUROENDOCRINE STRESS RESPONSES IN HEALTHY OLDER MEN AND WOMEN

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**Objectives:** Low socioeconomic status (SES) is associated with increased risk of cardiovascular disease. This relationship may be mediated in part through heightened stress-induced biological responses. Blood pressure (BP) stress responses are more prolonged following termination of stress in lower SES individuals, while plasma interleukin (IL)-6 responses are heightened. Abdominal adiposity is related to SES and is also associated with greater biological stress responses. We tested the hypothesis that abdominal adiposity accentuates the cardiovascular, neuroendocrine and inflammatory responses to psychological stress of lower SES individuals.

**Methods:** 543 healthy white European men and women aged 53-76 years from the Whitehall II epidemiological cohort underwent psychophysiological stress testing, in which cardiovascular, neuroendocrine and inflammatory responses were recorded in response to standardized behavioural tasks. Participants were divided into lower, intermediate and higher SES groups on

the basis of grade of employment. Abdominal adiposity was indexed by waist circumference.

**Results:** Stress stimulated marked increases in systolic BP (means 126.0 and  $\pm 14.8$  and  $156.7 \pm 22.0$  mmHg for baseline and stress periods), declining to  $134.9 \pm 176.5$  mmHg at 45 minutes post-stress. The magnitude of systolic BP responses did not vary with SES or waist circumference, but post-stress recovery was more rapid in higher SES individuals and those with small waist circumference, independently of age, gender and smoking status ( $p < 0.001$ ). Plasma IL-6 was inversely associated with SES and positively related to waist circumference independently of age, gender and smoking, and increased following stress. The highest IL-6 levels following stress were recorded in lower SES participants with larger waist circumferences ( $p < 0.001$ ). Greater waist circumference was associated with cortisol responsiveness to stress ( $p = 0.045$ ), but there was no interaction with SES.

**Conclusions:** Both abdominal adiposity and lower SES are associated with disturbances in stress-induced biological responses, including impaired BP recovery after stress, and heightened IL-6 and cortisol responses. However, the two factors were independently related to biological stress responses, and did not interact. The role of disturbed stress biology in mediating SES and abdominal adiposity influences on cardiovascular disease requires confirmation in prospective studies.

## THIGH CIRCUMFERENCE AND THE RISK OF HEART DISEASE AND PREMATURE DEATH

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**Objective:** To examine associations between thigh circumference and incident cardiovascular disease and coronary heart disease and total mortality.

**Design:** Prospective observational cohort study of a random subset of adults in Denmark. We used Cox proportional hazards model and restricted cubic splines to assess the 10 year incidence of cardiovascular and coronary heart disease and 12.5 years of follow-up for total death.

**Material:** 1436 men and 1380 women participating in the Danish MONICA project, examined in 1987-8 for height, weight, and thigh, hip, and waist circumference, and body composition by impedance.

**Results:** A small thigh circumference was associated with an increased risk of cardiovascular and coronary heart diseases and total mortality in both men and women. A threshold effect for thigh circumference was evident, with greatly increased risk of premature death below around 60 cm. Above the threshold there seemed to be no additional benefit of having larger thighs in either sex. These findings were independent of abdominal and general obesity, lifestyle, and cardiovascular risk factors such as blood pressure and lipid concentration.

**Conclusion:** A low thigh circumference seems to be associated with an increased risk of developing heart disease or premature death. The adverse effects of small thighs might be related to too little muscle mass in the region. The measure of thigh circumference might be a relevant anthropometric measure to help general practitioners in early identification of individuals at an increased risk of premature morbidity and mortality.

## ECTOPIC FAT DEPOSITION WITHIN SKELETAL MUSCLE AS DETERMINANT OF CAROTID ATHEROSCLEROSIS

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**Aim:** Besides visceral obesity, accumulation of fat in skeletal muscle and liver can exist in metabolic syndrome, cardiovascular disease, or both, independent of the degree of general adiposity. However, despite the importance of ectopic fat deposition, the association between fat deposition within muscle or liver and atherosclerosis or cardiovascular disease is yet to be fully elucidated. The aim of this study was to investigate whether altered fat distribution within skeletal muscle and liver is associated with a higher carotid artery intima-media thickness.

**Methods:** Seventy-three, drug-naïve men with newly-developed type 2 diabetes participated in this study. Using computed tomography scan which was measured at the L4-L5 intervertebral disc space and at the mid-point between the anterior superior iliac crest and the upper margin of the patella, abdominal visceral and subcutaneous fat areas, mid-thigh muscle attenuation, and liver attenuation characteristics were determined; the mid-thigh muscle was divided into low (0 to +34 Hounsfield units [HU])- and normal (+35 to +100 HU)-density muscle areas. Also, the carotid artery intima-media thickness was measured.

**Results:** Based on bivariate analyses, the abdominal visceral fat area was positively correlated with the mid-thigh low-density muscle area, and inversely with liver attenuation and mid-thigh muscle attenuation. The factors correlated with carotid intima-media thickness were age, waist circumference, HOMA-IR, abdominal visceral fat area, liver attenuation, mid-thigh low- and normal-density muscle areas, and mid-thigh muscle attenuation, but not abdominal subcutaneous fat area. In multiple regression analysis using carotid intima-media thickness as the dependent variable, age, HOMA-IR, mid-thigh low-density muscle area, and mid-thigh muscle attenuation were independent factors associated with carotid intima-media thickness. However, waist circumference, abdominal visceral fat area, mid-thigh normal-density muscle area, and liver attenuation did not contribute to the increased carotid intima-media thickness in this model.

**Conclusion:** High fat store within thigh skeletal muscle, but not the liver, was closely associated with carotid intima-media thickness, independent of the visceral fat depot.

## RELATIONS OF EPICARDIAL ADIPOSE TISSUE TO METABOLIC SYNDROME COMPONENTS ARE REGION-SPECIFIC AND INDEPENDENT OF ANTHROPOMETRIC INDEXES AND INTRA-ABDOMINAL VISCERAL FAT

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**Aims:** Epicardial adipose tissue (EAT) is a metabolically active visceral fat depot. Its distribution is asymmetrical and primarily concentrated in the grooves. To date, it remains unclear which measurement of EAT best reflects its metabolic risk. In this study, we aimed to examine the correlations between various multidetector computed tomographic (MDCT) measurements of

EAT, metabolic syndrome components, and plasma levels of high-sensitivity C-reactive protein (hsCRP) and adipokines.

**Methods:** This study included 148 consecutive patients undergoing MDCT prior to diagnostic coronary angiography. Thickness in the grooved segments, cross-sectional areas, and total volume of EAT were measured. The cross-sectional areas of subcutaneous and visceral abdominal fat depots were additionally measured in 70 randomly selected patients.

**Results:** Thickness of EAT in the left atrioventricular groove was the only EAT measurement significantly correlated with all 3 metabolic syndrome components (blood pressure, lipid, and glucose components) and plasma levels of resistin and hsCRP after age and gender adjustments. The association between left atrioventricular groove thickness and increasing number of metabolic syndrome components remained significant after additional adjustments for body-mass index, waist circumference, and intra-abdominal visceral fat area. By using the receiver-operating-characteristic analysis, the optimal cutoff point for left atrioventricular groove thickness to predict the presence of  $\geq 2$  metabolic syndrome components was 12.4 mm.

**Conclusions:** A simple measurement of EAT thickness in the left atrioventricular groove may provide a more accurate assessment of metabolic risk associated with EAT, which could not be accounted for by anthropometric indexes and intra-abdominal visceral fat.

#### NON-ALCOHOLIC FATTY LIVER DISEASE IS ASSOCIATED WITH METABOLIC SYNDROME IN OBESE CHILDREN

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**Objective:** This study aimed to investigate whether NAFLD is associated with MS profile, and reflects progression of MS as well.

**Subjects and methods:** We classified 305 obese children (9-14 years old) into three subgroups: group 0 (normal US liver and normal transaminases); group 1 (US fatty liver and normal transaminases); group 2 (US fatty liver and elevated transaminases). We measured body mass index (BMI), waist and hip circumference, blood pressure, fasting blood glucose, insulin, HOMA score, WBIS, the ratio of early insulin increment to early glucose increment (I30-0/G30-0) based on OGTT test, lipid profile and transaminases (ALT, AST) in all participants. Moreover, the risk of developing the MS were assessed according to the degree of liver fatty infiltration based on the B-ultrasound imagine examination.

**Results:** Among 305 obese children, 200 cases (65.6%) were classified as having NAFLD, and 76 cases (24.92%) had a metabolic syndrome (MS). The prevalence of the MS increased from 11.43% in group 0 to 29.93% in group 1 and 36.51% in group 2 ( $p < 0.05$ ). Moreover, there were significantly higher incidences concerning every component of MS in group 2 compared with group 0 ( $p < 0.05$ ). Based on the B-ultrasound scales, the presence of moderate and severe liver fatty infiltration carried a high risk of hypertension (OR=2.18, 95% CI 1.27- 3.75), dyslipidemia (OR=7.99, 95% CI 4.34-14.73), impaired fasting glucose (OR=3.65, 95% CI 1.04-12.85) and whole MS as well (OR, 3.77; 95% CI, 1.90-7.47,  $p < 0.01$ ). The state of insulin resistance (calculated by HOMA-IR and WBIS) deteriorated as the scale of fatty infiltration increased.

**Conclusion:** The presence of multiple metabolic disorders is always accompanying with a potentially progressive, severe liver disease. NAFLD may not only be a liver disease but also an early mediator of metabolic syndrome in obese children.

#### OMENTAL ADIPOCYTE HYPERTROPHY IS ASSOCIATED WITH HYPERTRIGLYCERIDEMIA IN WOMEN

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**Introduction:** Excess adipose tissue accumulation on the greater omentum and mesentery is strongly related to elevated triglyceride and low HDL-cholesterol levels. Fat gain results from adipocyte hyperplasia and/or hypertrophy, but the specific contribution of omental adipocyte hypertrophy as a predictor of metabolic abnormalities has never been investigated.

**Objective:** To examine the relationship between omental adipocyte hypertrophy and dyslipidemia in women.

**Methods:** Omental and subcutaneous adipose tissue samples were obtained in 168 women undergoing gynecological surgery. Adipocyte diameter was measured in cell suspensions of collagenase-digested tissues. Body composition and fat distribution were measured respectively by dual-energy x-ray absorptiometry and computed tomography. A detailed lipid profile was also obtained. Two subgroups of 10 women with either large or small omental adipocytes, but with similar age, total fat mass and subcutaneous adipocyte size were selected and compared.

**Results:** By design, omental adipocyte size was significantly higher in women with omental adipocyte hypertrophy compared to non-hypertrophic women ( $97 \pm 11$  vs.  $74 \pm 8 \mu\text{m}$ ,  $p < 0.01$ ). However, these two subgroups had similar numbers of adipocytes for both fat compartments and identical subcutaneous adipocyte sizes. Visceral adipose tissue area tended to be higher in hypertrophic compared to non-hypertrophic women ( $p = 0.06$ ). Plasma levels of triglycerides ( $p < 0.05$ ), VLDL-triglycerides ( $p < 0.05$ ) and HDL-triglycerides ( $p \leq 0.05$ ) were significantly higher in hypertrophic vs. non-hypertrophic women. In the entire sample ( $n = 168$ ), omental adipocyte size was significantly correlated with visceral adipose tissue area ( $r = 0.68$ ,  $p < 0.0001$ ), plasma levels of triglycerides ( $r = 0.51$ ,  $p < 0.0001$ ), Cholesterol ( $r = 0.29$ ,  $p < 0.0002$ ), VLDL-cholesterol ( $r = 0.47$ ,  $p < 0.0001$ ), HDL-cholesterol ( $r = -0.27$ ,  $p < 0.0005$ ), VLDL-triglycerides ( $r = 0.50$ ,  $p < 0.0001$ ) and LDL-triglycerides ( $r = 0.39$ ,  $p < 0.0001$ ). A trend was observed for the association between omental adipocyte size and HDL-triglyceride levels ( $r = 0.14$ ,  $p = 0.07$ ). Omental adipocyte size was the best predictor of plasma triglyceride and VLDL-triglyceride levels, explaining respectively 50% and 51% of the variance in models also including visceral adipose tissue area ( $p < 0.0001$  for both). Adding subcutaneous adipocyte size and subcutaneous adipose tissue area in the models did not alter these results.

**Conclusion:** Omental adipocyte hypertrophy is related to hypertriglyceridemia in women independent of adipocyte number, subcutaneous adipocyte size, body fat mass, abdominal adipose tissue areas and age.