Ethnic Differences in Blood Pressure and Vascular Function = what risk factors for the Cardio-Metabolic Syndrome are – in Children and Adolescents

Prof. Kennedy Cruickshank

President of the (European) Artery Society, 2016-18

Cardiovascular Medicine & Diabetes, King’s College & Health Partners (= Guy’s & St Thomas’ Hospitals) London, UK – 2018
Disclosures

• President of Artery..
Why arteries – NOT Risk Factors?

1. Universal requirement of effective blood supply to tissue growth

2. Lifecourse issues - conception, intrauterine, child→adult, older age (dementia..)

3. Cardiovascular dis. (T2 diabetes a CVS dis)

4. Tumour biology

5. Brain growth to senescence = ageing...

6. Injury – blood loss

  etc..
Arterial biomarker of SMALL & large vascular events in diabetes: Intermediate end-point

Number of CV events

Alteration in arterial parameter

Eg:
Pulse wave velocity (PWV)
Central (aortic) BP
Augmentation
Trajectories of systolic blood pressure (A) and body mass index (BMI) (B) from 1 to 20 years of age in offspring of normotensive (blue), pregnancy-induced hypertension (PIH; orange) and complicated hypertensive (red) pregnancies.

Esther F Davis et al. BMJ Open 2015;5:e008136
Course of Arterial Function as **Central Aortic Pressure** over Chronic ‘hypertensive’ Pregnancy

*Observational* data from the ‘Panda’ RC Trial of hypertensive treatment

Webster L et al, Cruickshank JK, Chapell L. *Hypertension* 2017

Webster L et al, Cruickshank JK, Chapell L. *Ultrasound in Obstet & Gynae* 2018
Course of Arterial Function as **Pulse Wave Velocity** in Chronic ‘hypertensive’ Pregnancy – mothers of SGA infants

*Observational* data from the ‘Panda’ RC Trial of hypertensive treatment

Webster L, et al
Cruickshank JK, Chapell L.
Hypertension 2017

Mothers with Small-for-Gestational Age ‘SGA’ infants, <10 %ile

Infants of ‘Control’ Hypertensive pregnancies

Webster L et al, Cruickshank JK, Chapell L.
Ultrasound in Obstet & Gynae 2018
DASH - health over the life course, ~1000 in each major London ethnic group

Early life & childhood

Adolescence 11-13y & 14-16y, (n=~6000)
- CVD, respiratory & Mental Health

21-23y: Pilot study (n=665)
- + bio-markers, arterial stiffness, accelerometry, dietary recall, own SEC, parenting
- qualitative interviews

Work life & beyond
- health & life trajectories
- future follow-up
- linkage of medical data
- generational studies
Systolic BP by BMI tertiles among adolescent girls

The MRC DASH Study in London Schools 11-13y olds

Harding S, Maynard M, Cruickshank JK. J Hypertension 2006
Systolic blood pressure from adolescence to early adulthood for males and females: association with longitudinal measures of adiposity* 
- at ages 21-23y

*Mixed-Effects Linear Regression Model coefficients adjusted for age, ethnicity, waist to height ratio (or BMI, or overweight status), parental/own employment and currently smoking.

<table>
<thead>
<tr>
<th></th>
<th>Coeff</th>
<th>95% CI</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Males</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Waist to height ratio</td>
<td>32.49</td>
<td>(22.05,42.93)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>BMI, kg/m²</td>
<td>0.17</td>
<td>(0.08,0.26)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Overweight (Normal weight - Ref)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overweight/Obese</td>
<td>1.74</td>
<td>(-0.31,3.79)</td>
<td>0.097</td>
</tr>
<tr>
<td><strong>Females</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Waist to height ratio</td>
<td>32.69</td>
<td>(24.84,40.55)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>BMI, kg/m²</td>
<td>0.54</td>
<td>(0.42,0.65)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Overweight (Normal weight - Ref)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overweight/Obese</td>
<td>3.75</td>
<td>(2.00,5.50)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Harding S et al.. Cruickshank JK – BMJ Open 2017
Pulse Wave Velocity (PWV) by Ethnicity in the London ‘DASH’ study - 2016

Cruickshank JK et al Hypertension 2016; 67: 1133-41
Feasibility Follow-up – ages 22-23y

Relationship of Pulse Wave Velocity with BP

\[ \rho = 0.18 \text{ (} p = 0.000 \text{)} \]

\[ \rho = 0.31 \text{ (} p < 0.001 \text{)} \]

Many young people already ‘stiffening’..?

Cruickshank et al Hypertension
June 2016
### Bogalusa Heart Study: multiple regression on *Longitudinal systolic BP at 15y*  
*(n= 182, Af.Am 92)*

<table>
<thead>
<tr>
<th>Variable</th>
<th>95% CI</th>
<th>Standard beta coefficients</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birth weight</td>
<td>-8.6 to 4.1</td>
<td>-0.36</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Height</td>
<td>0.27 to 0.57</td>
<td>0.38</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>BMI</td>
<td>0.30 to 0.85</td>
<td>0.3</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>ΔWT 04</td>
<td>-1.3 to –0.3</td>
<td>-0.25</td>
<td>0.01</td>
</tr>
<tr>
<td>SBP at 4y</td>
<td>0.08 to 0.44</td>
<td>0.19</td>
<td>&lt;0.01</td>
</tr>
</tbody>
</table>

NB: Ethnic difference in 15y BP ‘accounted for’ by birth weight  
Cruickshank et al Circulation 2005;111:1932-37
Severe childhood malnutrition (SCM) - still a problem…
- 2 distinct forms - via
  presence or absence of nutritional oedema:
  here F/up in Jamaica

Oedematous
(Kwashiorkor & Marasmic-kwashiorkor)

Non-oedematous
(Marasmus)
### Differences in cardiovascular measures (SD scores) - controls vs. all Malnutrn survivors at ±30y

<table>
<thead>
<tr>
<th>Measurement (standardised score)</th>
<th>Controls – all SAM survivors</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Controlled for age and sex</strong></td>
<td></td>
</tr>
<tr>
<td>Visceral fat mass</td>
<td>-0.09 (-0.45 to 0.27, 0.6)</td>
</tr>
<tr>
<td>Systolic blood pressure</td>
<td>-0.22 (-0.55 to 0.12, 0.2)</td>
</tr>
<tr>
<td><strong>Diastolic blood pressure</strong></td>
<td><strong>-0.40</strong> (-0.71 to -0.08, <strong>0.02</strong>)</td>
</tr>
<tr>
<td>Heart rate</td>
<td>0.21 (-0.14 to 0.56, 0.2)</td>
</tr>
<tr>
<td><strong>Pulse Wave Velocity</strong></td>
<td>0.35 (0.06 to 0.65, <strong>0.02</strong>)</td>
</tr>
<tr>
<td><strong>Stroke Volume</strong></td>
<td>0.49 (0.15 to 0.82, <strong>0.005</strong>)</td>
</tr>
<tr>
<td><strong>Cardiac Output</strong></td>
<td>0.56 (0.23 to 0.90, <strong>0.001</strong>)</td>
</tr>
<tr>
<td><strong>Ejection Fraction</strong></td>
<td>-0.41 (-0.76 to -0.06, <strong>0.02</strong>)</td>
</tr>
<tr>
<td><strong>LV outflow tract diameter</strong></td>
<td>0.71 (0.39 to 1.03, <strong>&lt;0.001</strong>)</td>
</tr>
<tr>
<td><strong>Systemic Vascular Resistance</strong></td>
<td>-0.69 (-1.03 to -0.35, <strong>&lt;0.001</strong>)</td>
</tr>
<tr>
<td><strong>LV Mass index</strong></td>
<td>-0.02 (-0.35 to 0.31, 0.9)</td>
</tr>
<tr>
<td>Central Systolic BP</td>
<td>-0.15 (-0.47 to 0.18, 0.4)</td>
</tr>
</tbody>
</table>

**Notes:**
- Tennant-Martin et al – Hypertension 2014
Vascular resistance & LV outflow tract +/- 30 years after Malnutrition

Tennant-Martin et al – Hypertension 2014;64:664-71
Lifetime transition..?

Recovered Kwashiorkor, small baby...

High BP
Type 2 Diabetes

? Population Risk?
The Impact of Malaria in Pregnancy on Changes in Blood Pressure in Children During Their First Year of Life

Omolola O. Ayoola, Olayemi O. Omotade, Isla Gemmell, Peter E. Clayton,* J. Kennedy Cruickshank*

_Hypertension_. 2014;63:167-172

### Table 3. Regression Analyses for Determinants of Change in Infant Blood Pressure

<table>
<thead>
<tr>
<th>Variable</th>
<th>ΔSBP</th>
<th>95% CI</th>
<th>P Value</th>
<th>R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–12 mo</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex (boy/girl)</td>
<td>-4.4</td>
<td>-7.72 to -1.08</td>
<td>0.01</td>
<td></td>
</tr>
<tr>
<td>Malaria status</td>
<td>3.64</td>
<td>0.32 to 6.95</td>
<td>0.03</td>
<td></td>
</tr>
<tr>
<td>Length SDS 0–3</td>
<td>-1.98</td>
<td>-3.56 to -0.40</td>
<td>0.014</td>
<td></td>
</tr>
<tr>
<td>Weight SDS 0–3</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td></td>
</tr>
<tr>
<td>Weight SDS 0–12</td>
<td>2.41</td>
<td>0.98 to 3.84</td>
<td>0.001</td>
<td>0.10</td>
</tr>
</tbody>
</table>

### Table 2. Comparison of Infant BP by Maternal Malaria With US BP Percentiles

<table>
<thead>
<tr>
<th>BP Percentile</th>
<th>Boys (n=173)</th>
<th>12 Mo (n=318)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MP No (n=86)</td>
<td>MP Yes (n=87)</td>
</tr>
<tr>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>&lt;90th</td>
<td>70</td>
<td>70</td>
</tr>
<tr>
<td>90th–94th</td>
<td>10</td>
<td>4</td>
</tr>
<tr>
<td>≥95th</td>
<td>6</td>
<td>13</td>
</tr>
</tbody>
</table>

BP indicates blood pressure; and MP, maternal malarial parasites detected.
Nigerian birth cohort – BP change up to age 3y by maternal malarial status

![Graph showing the relationship between mean change in systolic BP and years since birth by maternal malarial status.](image)

- Maternal malaria +ve
- Unexposed ‘controls’

*P = 0.03, P = 0.06, P = 0.007*

Increased Vasc GFs

*Courtesy of Jasmin Farikullah-Mirza, O Ayoola, Clayton P & our team – 2016*
The Malaria-High Blood Pressure Hypothesis

Anthony O. Etyang, Liam Smeeth, J. Kennedy Cruickshank, J. Anthony G. Scott

24-hour Sys/ Diast. BPs, adolescents 12-16y in Nairobi, Kenya, 2015-2016; i: Sickle Cell Trait vs controls

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>24-hour SBP1</th>
<th>24-hour DBP2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( \beta ), CI</td>
<td>p-value</td>
</tr>
<tr>
<td>Age, years</td>
<td>0.6(0.07 to 1.1)</td>
<td>0.027</td>
</tr>
<tr>
<td>Male Sex</td>
<td>2.4(0.4 to 4.3)</td>
<td>0.016</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>0.6(0.2 to 1)</td>
<td>0.001</td>
</tr>
<tr>
<td>eGFR (mls/min/1.73m²)</td>
<td>0.08(0.01 to 0.15)</td>
<td>0.017</td>
</tr>
<tr>
<td>PWV (ms⁻¹)</td>
<td>2.8(1.6 to 4.1)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Sickle carrier status</td>
<td>0.1(-2.4 to 2.6)</td>
<td>0.923</td>
</tr>
</tbody>
</table>

ii. Thalassaemia
Why ask..? Check effect separate from exposure to malaria

Table 2. Regression Analyses Investigating Possible Effect of Thalassemia Status on 24-Hour Systolic and Diastolic BP

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>24-Hour SBP</th>
<th>24-Hour DBP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( \beta ), 95% CI</td>
<td>P Value</td>
</tr>
<tr>
<td>Age, y</td>
<td>0.6 (0.1–1.2)</td>
<td>0.021</td>
</tr>
<tr>
<td>Male sex</td>
<td>2.6 (0.7–4.5)</td>
<td>0.009</td>
</tr>
<tr>
<td>BMI, kg/m²</td>
<td>0.6 (0.2–1)</td>
<td>0.001</td>
</tr>
<tr>
<td>PWV, ms⁻¹</td>
<td>2.8 (1.6–4.1)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>eGFR, ml/min per 1.73 m²</td>
<td>0.1 (0.03–0.2)</td>
<td>0.006</td>
</tr>
<tr>
<td>( \alpha )thalassaemia genotype</td>
<td>0.04 (–1.4 to 1.5)</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Etyang A et al, Cruickshank JK & Scott A. JAHA 2017
BP distribution in 35-66y olds – Kilifi, Kenya; ABPM vs Usual

Etyang, Smeeth, Cruickshank & Scott
Metabol(om)ic Issues
Does ‘healthy’ metabolic obesity exist?

A. CVS disease events

Incident T2 Diabetes by GTT

From: ‘Metabolically healthy obesity and risk of CVD events and T2 diabetes: the Whitehall II cohort study’.
- Hinnouho G-M et al. Eur Heart J 2015; 551=559
Adult type 2 diabetes according to birth weight for Danish women (A) and men (B).

HRs and 95% Cis – National cohort; n=7000+/ gender

BUT, is T2 Diabetes ‘diabetes as understood?’
N= 2500, of total ±21,000, in our centre in Manchester, UK
Vascular disease in (T2) diabetes

Chicken, egg or neither - Jarrett R, 1984

Common soil hypothesis – Stern M, 1995

Glycaemia - ? essential

? Earlier molecules..??

Is this the culprit??

Vascular impairment / ‘disease’

Retinal ? renal

? cardiac

Aorta, Coronary, Cerebral
Large Vessel Function
in ‘T2 diabetes’

NB: RC Trial outcome problems.
Age adjusted cardiovascular death rates with and without diabetes at screening for MRFIT

CVD death rates by Systolic Blood Pressure

- Death rates per 10,000 person-yrs without diabetes
- Death rates per 10,000 person-yrs with diabetes

Pulse Wave Velocity (PWV) vs SBP for all T2 Diabetes & GTTd Controls

-Alive
- Died

Vacarro et al 2003
NB: Accord Trial data 2010

Cruickshank et al Circulation 2002

Systolic BP mmHg

Pulse Wave Velocity (m/s)
Small vessel function – pre-Diabetes & T2 DM
Perivascular adipose tissue (PVAT)

Role in vascular tone?

courtesy of A Greenstein
29 women consented to fat biopsies, with small arteries mounted on a wire myograph.

ED-dilation significantly reduced in arteries from women in both GDM and UQ groups vs. controls, \( P=0.02 \)

Endothelial Function in different groups

Long chain fatty acids differing between control HAPO women (<median at 28/40 week pregnancy GTT or weight) and Upper Quartile groups at 2-y follow-up.

Fig 3. Phospholipids that differing significantly between control and UQ groups at 2-y follow-up.

Anderson SG, Dunn WB, Banerjee M et al., Cooper G, Kell DB, Cruickshank JK. Evidence that Multiple Defects in Lipid Regulation Occur before Hyperglycemia during the Prodrome of Type-2 Diabetes. PLoS ONE (2014)9(9): e103217. doi:10.1371/journal.pone.0103217
Comparison of 2 Fatty Acid clusters from PCA. The clusters (components) have patterns characterized by higher or lower proportions of saturated and polyunsaturated fatty acids.

Cluster 4 = Lower PWV and Lower Mortality

Anderson SG, Sanders TAB, Cruickshank JK. Hypertension 2009;53:839-45
Ceramides

Figure 4. A and B, Kaplan–Meier estimates of incident major adverse cardiovascular event (MACE) Cer(d18:1/18:0) and low-density lipoprotein-cholesterol (LDL-C) quartiles. A hazard ratio in the legend indicates the quartile-specific hazard relative to the first quartile (models stratified for sex).

<table>
<thead>
<tr>
<th>Baseline Characteristic</th>
<th>Men (N=3790)</th>
<th>Women (N=4311)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total cholesterol mmol/L</td>
<td>5.6 (4.9 — 6.3)</td>
<td>5.4 (4.8 — 6.1)</td>
</tr>
<tr>
<td>HDL cholesterol mmol/L</td>
<td>1.3 (1.1 — 1.5)</td>
<td>1.6 (1.4 — 1.9)</td>
</tr>
<tr>
<td>LDL cholesterol mmol/L</td>
<td>3.4 (2.9 — 4.1)</td>
<td>3.2 (2.6 — 3.7)</td>
</tr>
<tr>
<td>Triglycerides mmol/L</td>
<td>1.4 (1.0 — 2.0)</td>
<td>1.1 (0.8 — 1.4)</td>
</tr>
<tr>
<td>Systolic blood pressure mm Hg</td>
<td>135 (124 — 148)</td>
<td>129 (117 — 145)</td>
</tr>
<tr>
<td>Age y</td>
<td>50 (38 — 59)</td>
<td>47 (36 — 58)</td>
</tr>
<tr>
<td>BMI kg/m²</td>
<td>26.8 (24.5 — 29.5)</td>
<td>25.7 (22.9 — 29.3)</td>
</tr>
</tbody>
</table>
Two metabolite clusters associated with **INCREASED** and **DECREASED** risk of INCIDENT T2D (n=800) – The POTSDAM & KORA-Augsberg cohorts (n= 2282 controls).

Floegel A et al, Diabetes 2013;62:639-648
Metabolomics in GDM pregnancies

Sara L. White

Diabetologia (2017) 60:1903–1912

± 17 weeks

± 28-32 weeks

Fig. 1 Differences in lipoprotein particle groups between GDM and non-GDM women

Positive associations with GDM → the right
STATIN trials.. – eg: ‘CARDS’: Cumulative Hazard for Any CVD Endpoint

Relative Risk Reduction = 32% (95% CI 15-45)
p = 0.001

Cumulative Hazard for Any CVD Endpoint

Placebo
Atorvastatin

1\(^{0}\) NNT 30 pts over 3+ yrs

What can we do about all this?

Challenge of *direct* prevention & treatment for blood vessels

= effective, BP-dependent AND *independent* treatment

- Exercise
- Nutrient / Food-based
- Drugs
An anti-reductionist Hypothesis for:

*Intergenerational* transmission of RISK / Susceptibility to ill-health among (African-) Caribbean (& Indo-Asian) populations

- in the Caribbean region, Indian sub-continent, sub-Saharan Africa, Middle East & MOST LMICs now.
Developmental & Environmental, rather than genetic-variant, bases for ethnic variation in High Blood Pressure - & Diabetes / Vascular disease

Perspective

1. Natural History of Disease

2. It’s a long way from genome to phenotype:

- A far cry from genome variants..
Sick genes, Sick individuals or Sick populations with chronic disease? An example from studying diabetes & hypertension in African-origin populations.

JK Cruickshank, J-C Mbanya, R Wilks, B Balkau, N McF Anderson, T Forrester

*Int J Epidemiol* 2001; 30: 111-117
**Intergenerational** transmission of CVS risk among Caribbean (& global?) peoples

**Forces of HISTORY & Society**

- Maternal phenotype
- Slavery & slow escape from post-emancipation poverty / indentured labour

**Individual adaptation**

- Genetics
- Early childhood growth
- Adolescent growth

**Social**

- Early childhood growth
- Nutrition

**Health FACTORS**

- Adolescent
- Adult

**Lifespan**

---

**Intergenerational** transmission of CVS risk among Caribbean (& global?) peoples.
SES, 7 global risk factors in the 25x25 study vs total & 4-cause mortality

**The Lancet** Feb 2017
DOI: [10.1016/S0140-6736(16)32380-7](https://doi.org/10.1016/S0140-6736(16)32380-7)

Stringhini S et al., Kivimäki, M for the the LIFEPATH consortium
Age adjusted cardiovascular disease death rates for men with and without diabetes at initial screening for MRFIT.

CVD death rates by Systolic Blood Pressure

Vaccarro O et al, Diab Care 2003
aPWV by blood pressure & age

- European PWV Collab Group, Eur Heart J 2010
The ‘null’ hypothesis

More (High) Blood Pressure in W Afrs & Caribbeans but for given BP levels (eg: ‘x’), no difference in outcomes..

- Cruickshank 1989
Amplification of BP from the ascending aorta to the brachial artery in a young subject

Parker K et al. 2004
Variation in Flow and Pressure across the Arterial tree.. (modelled)

Note resulting Pulse Wave Velocity changes (estimated)

The Diabetes ‘Phenotype’..?

Courtesy of Dr A Figueroa, King’s College


Ben-Shlomo Y et al, JACC 2014

<table>
<thead>
<tr>
<th></th>
<th>Model 1*</th>
<th>Model 2*</th>
<th>Model 3*</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHD events (n = 1,195)</td>
<td>1.35 (1.22-1.50)</td>
<td>1.32 (1.18-1.48)</td>
<td>1.23 (1.11-1.35)</td>
</tr>
<tr>
<td>CVD events (n = 1,785)</td>
<td>1.45 (1.30-1.61)</td>
<td>1.37 (1.23-1.52)</td>
<td>1.30 (1.18-1.43)</td>
</tr>
<tr>
<td>Stroke events (n = 641)</td>
<td>1.54 (1.34-1.78)</td>
<td>1.37 (1.21-1.54)</td>
<td>1.28 (1.16-1.42)</td>
</tr>
<tr>
<td>CVD mortality (n = 395)</td>
<td>1.41 (1.27-1.56)</td>
<td>1.35 (1.20-1.53)</td>
<td>1.28 (1.15-1.43)</td>
</tr>
<tr>
<td>All-cause mortality (n = 2,041)</td>
<td>1.22 (1.16-1.27)</td>
<td>1.20 (1.15-1.26)</td>
<td>1.17 (1.11-1.22)</td>
</tr>
</tbody>
</table>

*Model 1 adjusts for sex and age group; model 2 adjusts for sex, age group, and systolic blood pressure; and model 3 additionally adjusts for other risk factors (cholesterol, high-density lipoprotein cholesterol, smoking status, presence of diabetes, and antihypertensive medication), stratified by race in the Sutton-Tyrell study (27). Not all studies had data on every risk factor.

aPWV = aortic pulse wave velocity; CHD = coronary heart disease; CI = confidence interval; CVD = cardiovascular disease.
Age adjusted cardiovascular death rates with and without diabetes at screening for MRFIT

CVD death rates by Systolic Blood Pressure

- without diabetes
- with diabetes

Arterial Stiffness as Pulse Wave Velocity (PWV) vs SBP for all T2 Diabetes & GTTd Controls

Vacarro et al 2003

NB: Accord Trial data 2010

Cruickshank et al Circulation 2002
HAPO study – Manchester cohort
(n=957)

Follow-up, median 22 months after birth
(n=250)

CONTROL GROUP
Women with FPG ≤4.5 and 2-hr plasma glucose ≤5.8 mmol/l (from the lower half of the whole distribution for the original 957 women) (n=43)

Upper Quartile (UQ) GROUP
Women with FPG ≥4.8 but <5.5 and/or a 2-hr glucose of ≥6.8 but <7.8, mmol/l (from the upper quartile (‘UQ’) of the whole distribution for the original 957 women (n=39)

GDM GROUP
Women who had fulfilled the WHO definition of overt gestational diabetes (GDM) at their HAPO GTT (n=18)
Small artery function 2 years postpartum in women with altered glycaemic distributions in their preceding pregnancy

*Cardiovascular Sciences Research Group, University of Manchester Core Technology Facility, 46 Grafton Street, Manchester M13 9NT, U.K., and †Diabetes, Nutrition and Cardiovascular Medicine, Franklin-Wilkins Building, King’s College London, 150 Stamford Street, London SE1 9NH, U.K.
‘HAPO’ study follow-up - Impaired Endothelial function 2 years post-partum in ex-GDM and pregnancy Upper glycaemic Quartile

- 29 women consented to fat biopsies, with small arteries mounted on a wire myograph

- ED-dilation significantly reduced in arteries from women in both GDM and UQ groups vs. controls, $P=0.02$

Mean proportion (weight %) of fatty acid by ethnicity and tertiles* of PWV.

A. Proportion of EPA (20:5n-3)
B. Proportion of DHA (22:6n-3)
C. Proportion of Linoleic acid (18:2n-6; LA)
D. Proportion of AA (20:4n-6)

Anderson SG, Sanders `TAB, Cruickshank JK
*Hypertension
2009;53:839-45
<table>
<thead>
<tr>
<th>Characteristic</th>
<th>No GDM (n = 448)</th>
<th>GDM (n = 198)</th>
<th>p value&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>African</td>
<td>59 (13.2)</td>
<td>38 (19.2)</td>
<td>0.35</td>
</tr>
<tr>
<td>Afro-Caribbean</td>
<td>27 (6.0)</td>
<td>14 (7.1)</td>
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</tr>
<tr>
<td>South Asian</td>
<td>33 (7.4)</td>
<td>14 (7.1)</td>
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</tr>
<tr>
<td>European</td>
<td>290 (64.7)</td>
<td>116 (58.6)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>39 (8.7)</td>
<td>16 (8.1)</td>
<td></td>
</tr>
<tr>
<td>Parity</td>
<td></td>
<td></td>
<td>0.85</td>
</tr>
<tr>
<td>Nulliparous</td>
<td>193 (43.1)</td>
<td>89 (44.9)</td>
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<tr>
<td>Multiparous</td>
<td>255 (56.9)</td>
<td>109 (55.1)</td>
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<tr>
<td>Current smoking status</td>
<td></td>
<td></td>
<td>0.53</td>
</tr>
<tr>
<td>Non-smoker</td>
<td>420 (93.8)</td>
<td>183 (92.4)</td>
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<tr>
<td>Smoker</td>
<td>28 (6.3)</td>
<td>15 (7.6)</td>
<td></td>
</tr>
<tr>
<td>Age, years</td>
<td>30.5 ± 5.6</td>
<td>31.5 ± 4.6</td>
<td>0.027</td>
</tr>
<tr>
<td>Height, cm</td>
<td>164.2 ± 6.6</td>
<td>163.6 ± 7.1</td>
<td>0.29</td>
</tr>
<tr>
<td>Weight, kg</td>
<td>95.5 (87.1–105.8)</td>
<td>96.6 (88.9–107.0)</td>
<td>0.17</td>
</tr>
<tr>
<td>BMI, kg/m&lt;sup&gt;2&lt;/sup&gt;</td>
<td>34.7 (32.6–38.5)</td>
<td>36.1 (33.0–39.4)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Systolic BP, mmHg&lt;sup&gt;b&lt;/sup&gt;</td>
<td>116.4 ± 10.8</td>
<td>120.6 ± 10.7</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>GA at time point 1, weeks</td>
<td>16.9 ± 1.1</td>
<td>17.0 ± 1.0</td>
<td>0.47</td>
</tr>
<tr>
<td>GA at time point 2, weeks</td>
<td>27.7 ± 0.7</td>
<td>27.8 ± 0.6</td>
<td>0.48</td>
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<tr>
<td>Randomisation</td>
<td></td>
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<td>0.63</td>
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<tr>
<td>Control</td>
<td>226 (50.4)</td>
<td>104 (52.5)</td>
<td></td>
</tr>
<tr>
<td>Intervention</td>
<td>222 (49.6)</td>
<td>94 (47.5)</td>
<td></td>
</tr>
</tbody>
</table>
Challenge

= effective, BP-independent treatment

- Exercise
- Nutrient / Food-based
- Drugs
Adjusted Risk of Cardiovascular Events by Level of Fresh Fruit Consumption in 750,000 Chinese

Du H et al
NEJM
2016; 374: 1332-1343.
18-20 October 2018
Centro Cultural Vila Flor
Guimarães, Portugal
www.arterysociety.org

Abstract Submission
Deadline: 18 June 2018

Early Bird Registration
Deadline: 11 August 2018
2ª. REUNION DE ARTERY LATINOAMERICA
II Meeting of Artery LATAM

Universidad de Guadalajara / University of Guadalajara
5-6 de Julio de 2018 / 5-6th July 2018
Guadalajara, Jalisco, Mexico.
Guadalajara, Mexico
Julio 5–6th 2018

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