



Lo scompenso cardiaco nel diabete, la causa (e il rimedio) è metabolica o emodinamica?

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Conflitti di Interesse di Angelo Avogaro

Dichiaro che negli ultimi 2 anni ho ricevuto compensi per advisory board e relazioni dalle seguenti aziende:

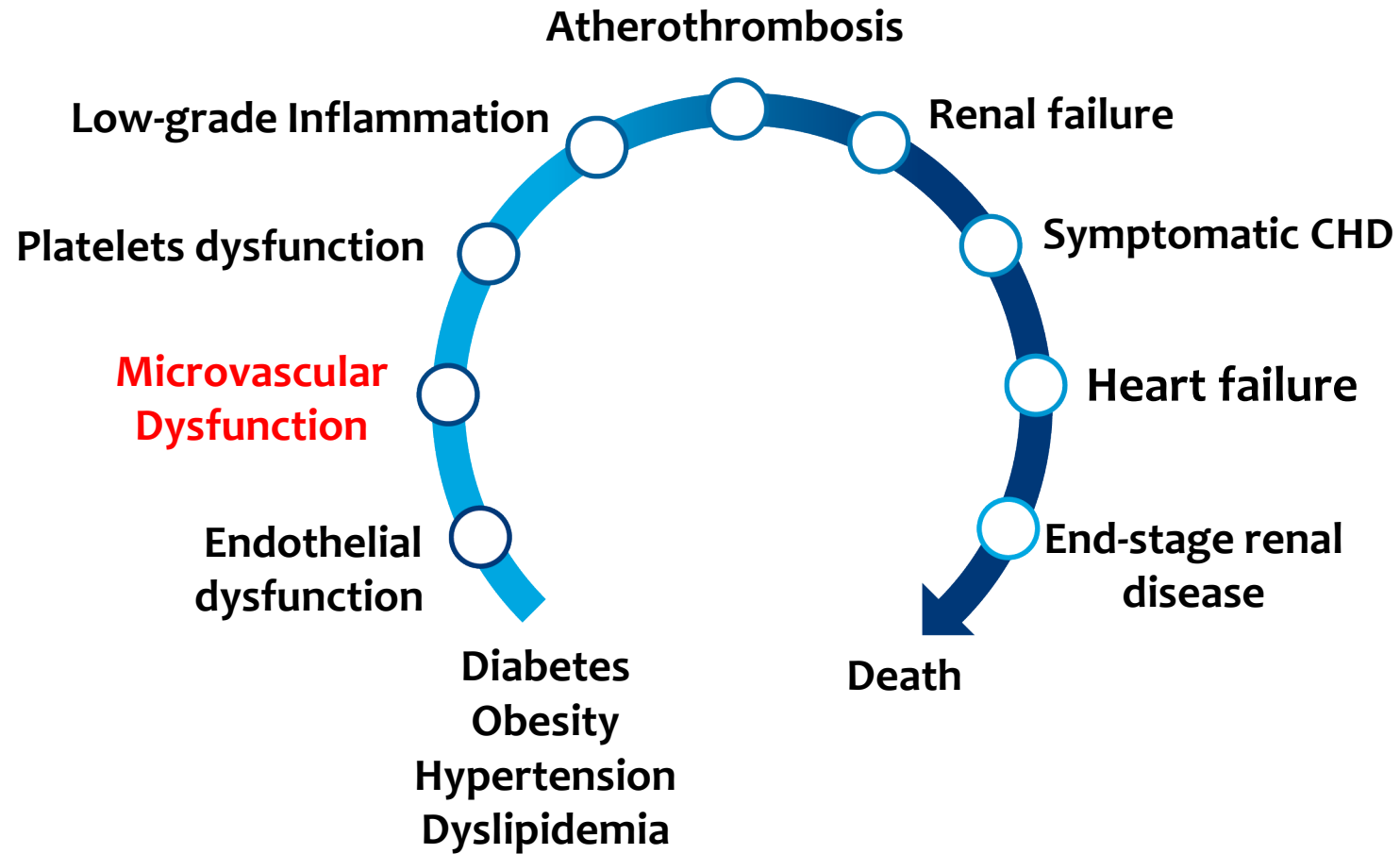
AstraZeneca, Boehringer Ingelheim, Bayer, Eli Lilly, Guidotti, Amgen, Servier, Merck Sharp & Dohme, Novo Nordisk, Sanofi.

Machine Learning to Predict the Risk of Incident Heart Failure Hospitalization Among Patients With Diabetes: The WATCH-DM Risk Score

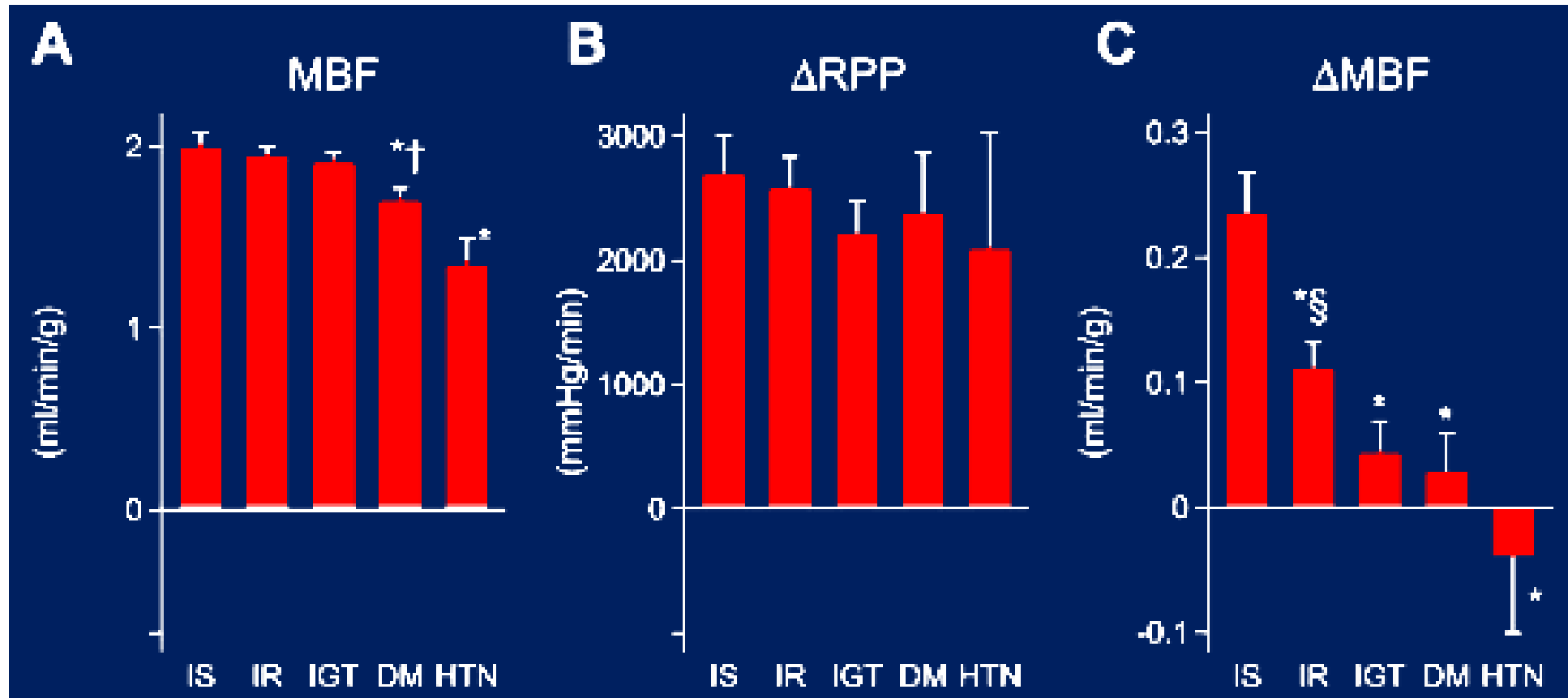
Diabetes Care. 2019;42(12):2298-2306. doi:10.2337/dc19-0587

<table><tr><th colspan="2">Age (yrs)</th></tr><tr><td>< 50</td><td>0</td></tr><tr><td>50 - 54</td><td>1</td></tr><tr><td>55 - 59</td><td>2</td></tr><tr><td>60 - 64</td><td>3</td></tr><tr><td>65 - 69</td><td>4</td></tr><tr><td>70 - 74</td><td>5</td></tr><tr><td>≥ 75</td><td>6</td></tr></table>	Age (yrs)		< 50	0	50 - 54	1	55 - 59	2	60 - 64	3	65 - 69	4	70 - 74	5	≥ 75	6	<table><tr><th colspan="2">BMI (kg/m²)</th></tr><tr><td>< 25</td><td>0</td></tr><tr><td>25 - 34</td><td>1</td></tr><tr><td>35 - 39</td><td>2</td></tr><tr><td>≥ 40</td><td>5</td></tr></table>	BMI (kg/m ²)		< 25	0	25 - 34	1	35 - 39	2	≥ 40	5	<table><tr><th colspan="2">SBP (mmHg)</th></tr><tr><td>< 100</td><td>0</td></tr><tr><td>100 - 139</td><td>1</td></tr><tr><td>140 - 159</td><td>2</td></tr><tr><td>≥ 160</td><td>3</td></tr></table>	SBP (mmHg)		< 100	0	100 - 139	1	140 - 159	2	≥ 160	3	<table><tr><th colspan="2">FPG (mg/dL)</th></tr><tr><td>< 125</td><td>0</td></tr><tr><td>125 - 199</td><td>1</td></tr><tr><td>200 - 299</td><td>2</td></tr><tr><td>≥ 300</td><td>3</td></tr></table>	FPG (mg/dL)		< 125	0	125 - 199	1	200 - 299	2	≥ 300	3
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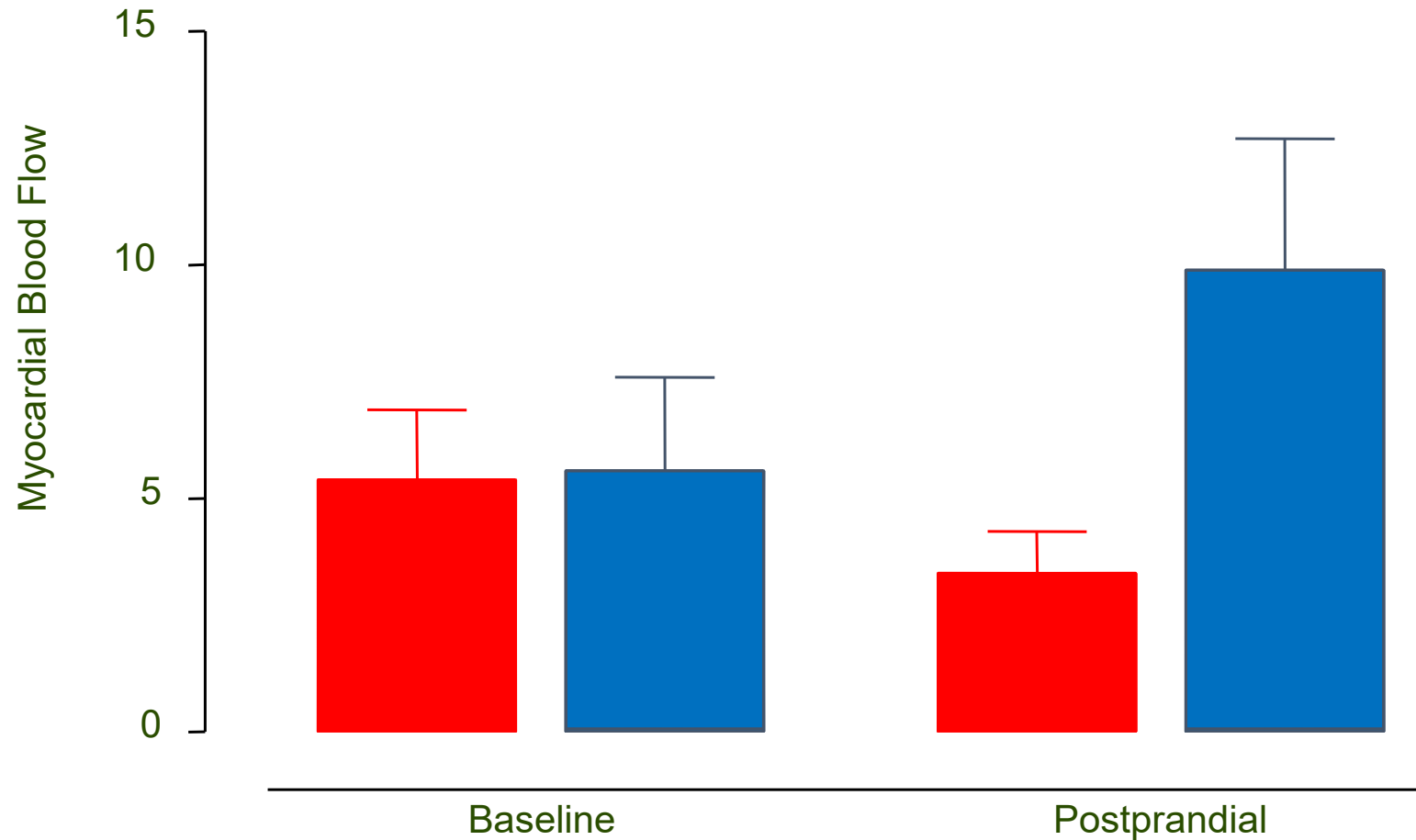
The cardio-metabolic clock



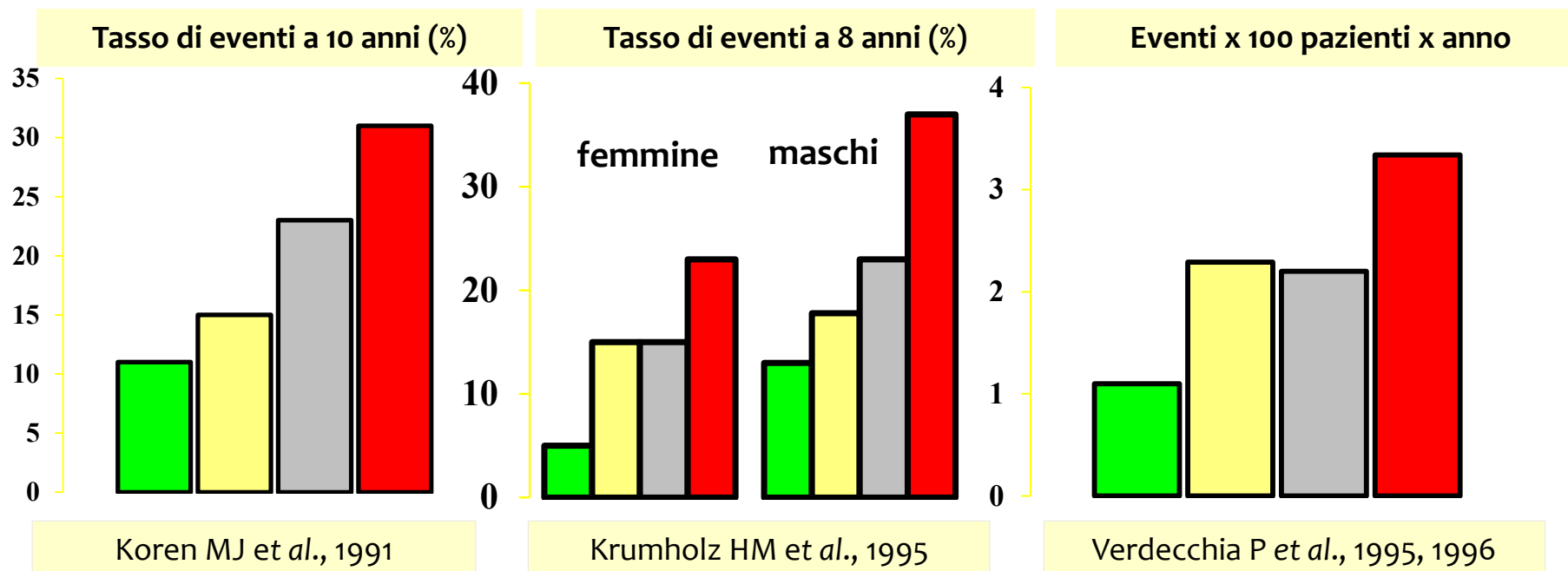
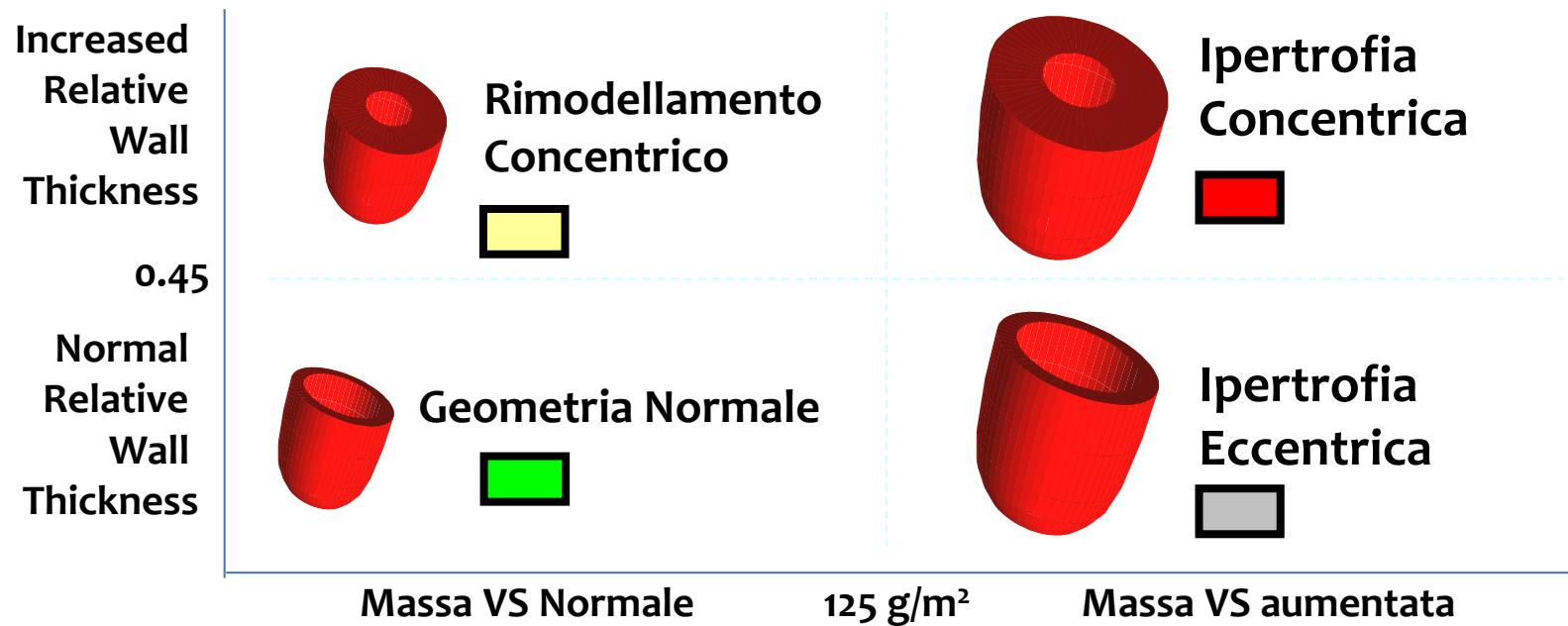
Microvascular Reactivity according to different glucose tolerance states



Patients with type 2 diabetes without ATS show compromised meal-related increase in myocardial blood-flow



Scognamiglio et al. Circulation, 2005



Microvascular
ischaemia

LVH

MI

No MI

"Transition to failure"

MI

No MI

Microvascular
ischaemia

cLVH

Low EF

Symptomatic heart
failure with **normal** EF

Symptomatic heart
failure with **low** EF

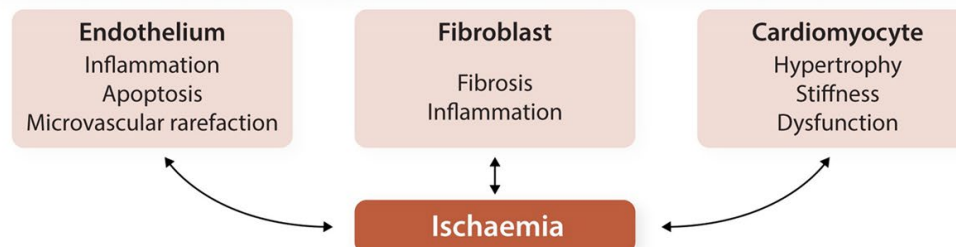
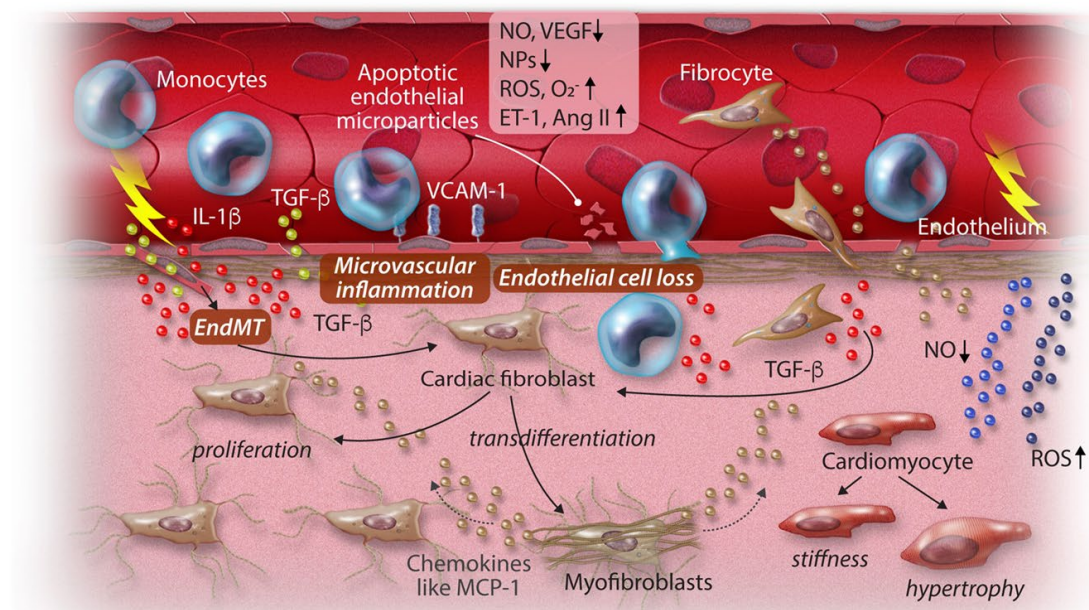
Contribution of
myocardial
ischaemia in the
progression from
LVH to heart
failure.

Risk factors like obesity, hypertension, hyperglycemia, dyslipidemia

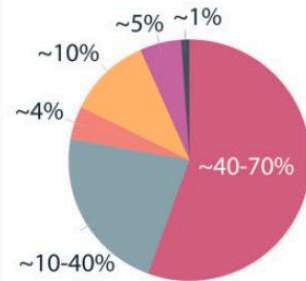
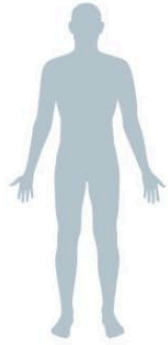
Systemic low-grade inflammation

Endothelial dysfunction

Endothelial dysfunction
provokes cardiomyocyte
stiffness/hypertrophy



Adult heart



■ FAs oxidation

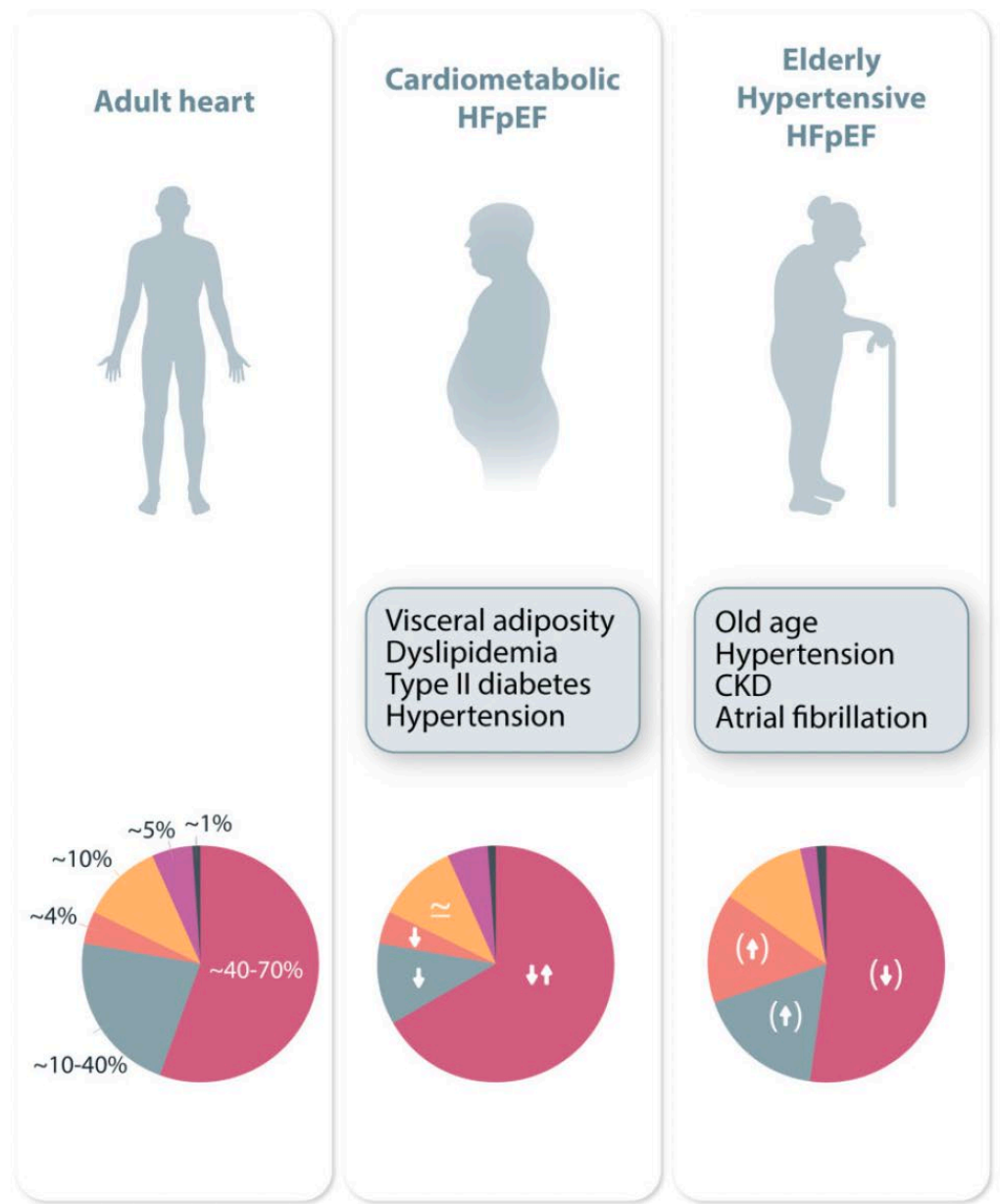
■ KB oxidation

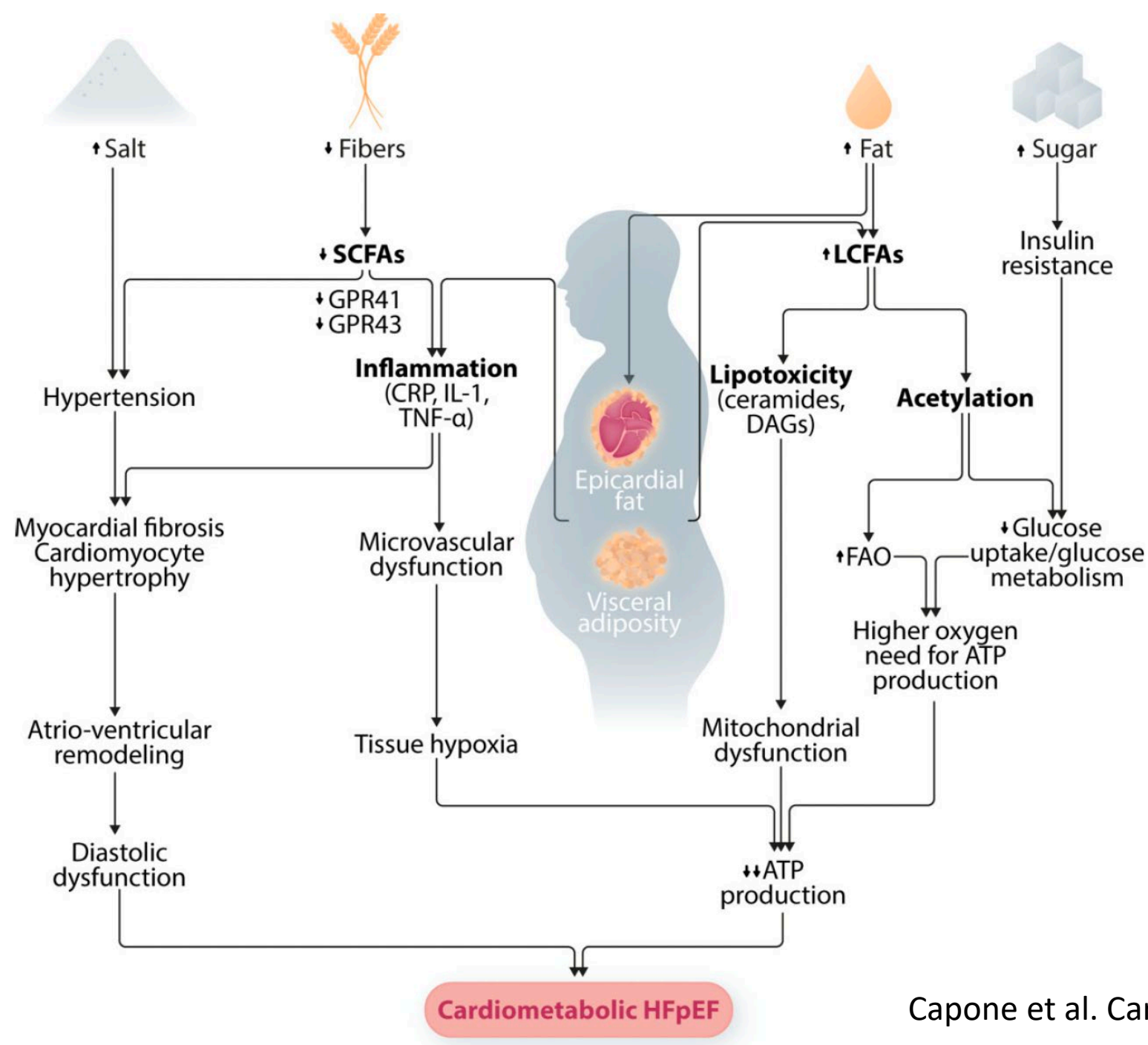
■ Glucose oxidation

■ Lactate oxidation

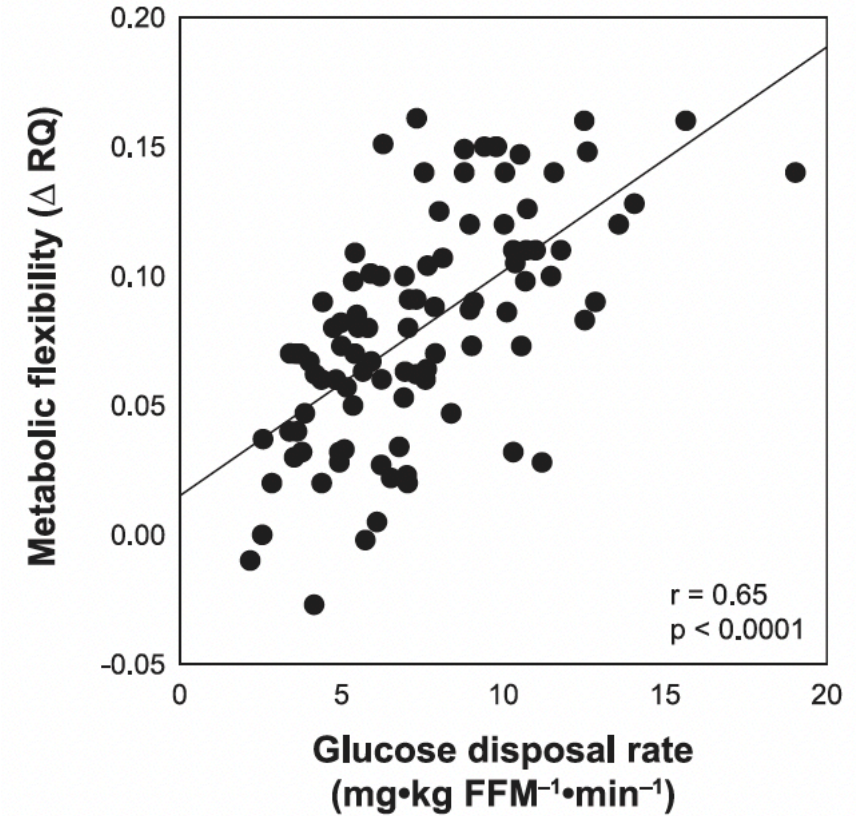
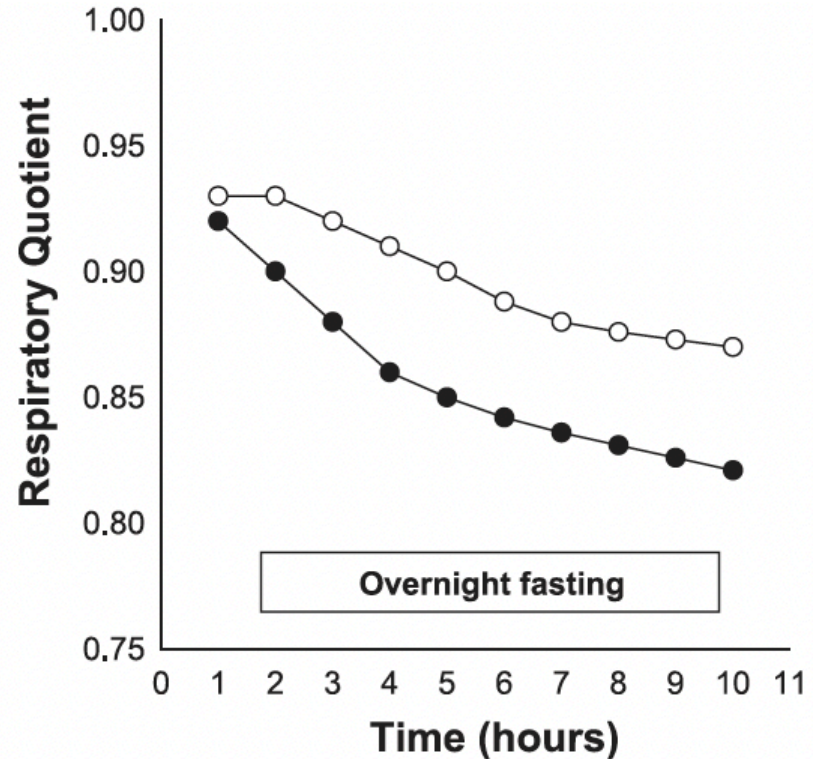
■ Glycolysis

■ BCAA oxidation





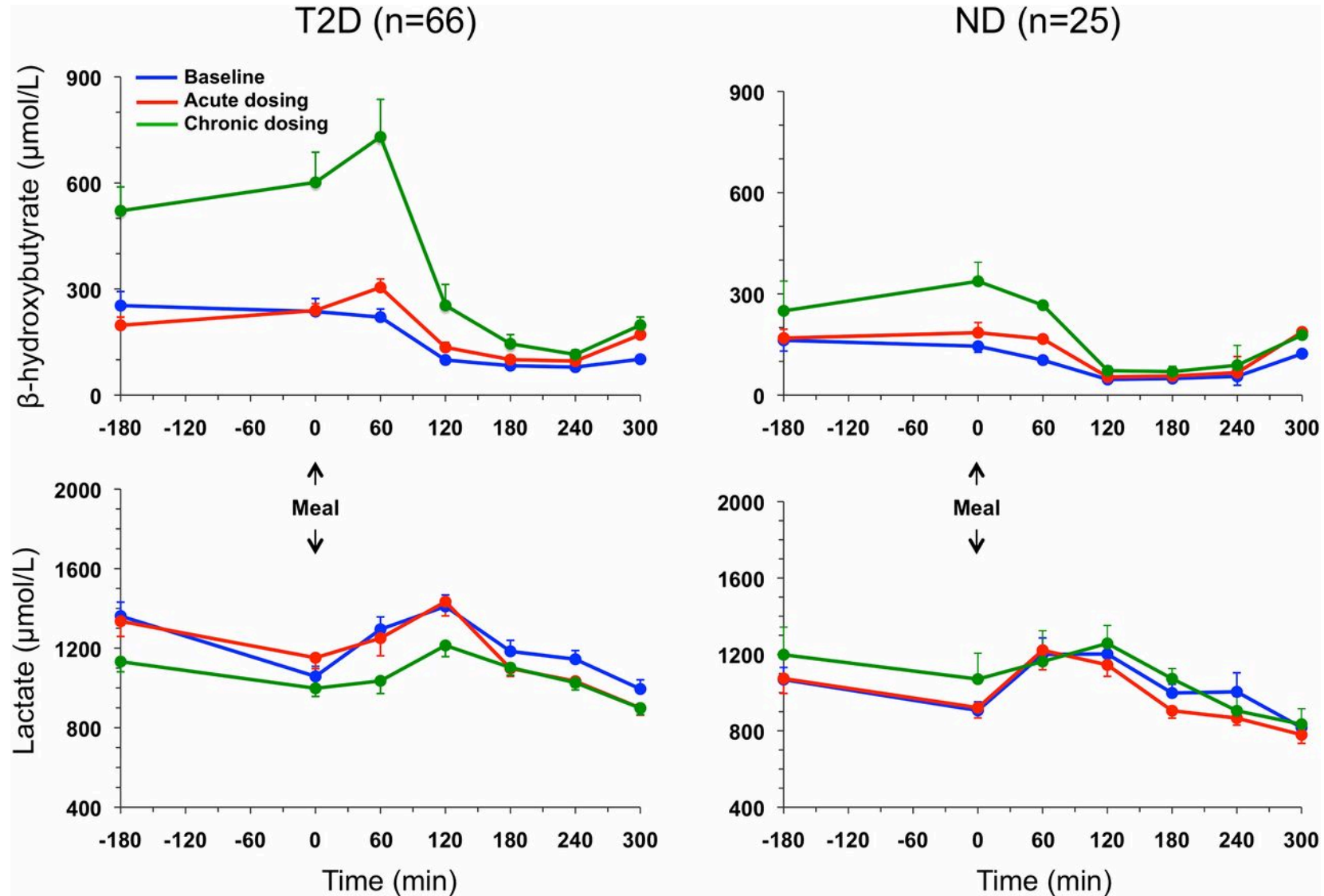
Metabolically Flexible and Inflexible

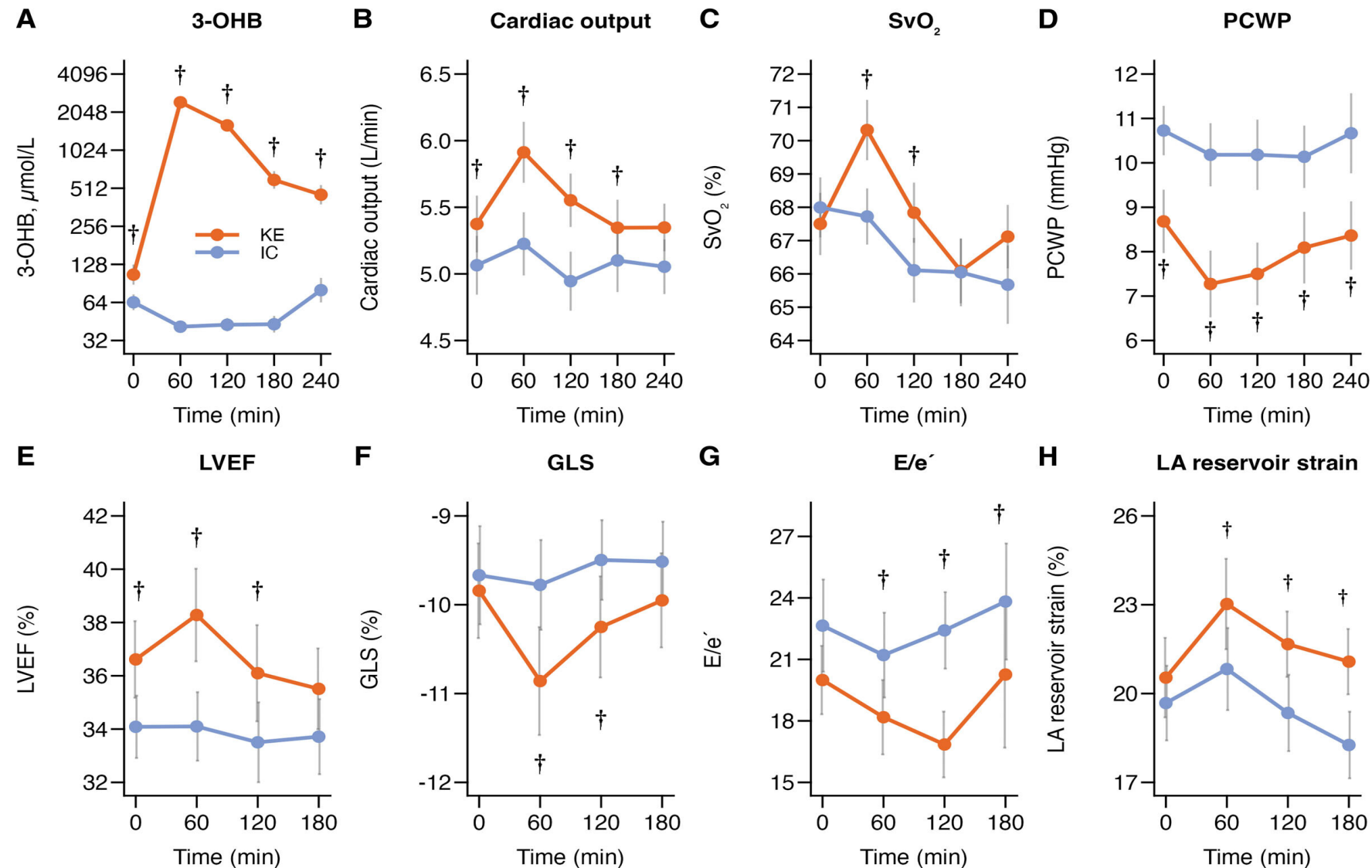


The “Energetic Convenience”

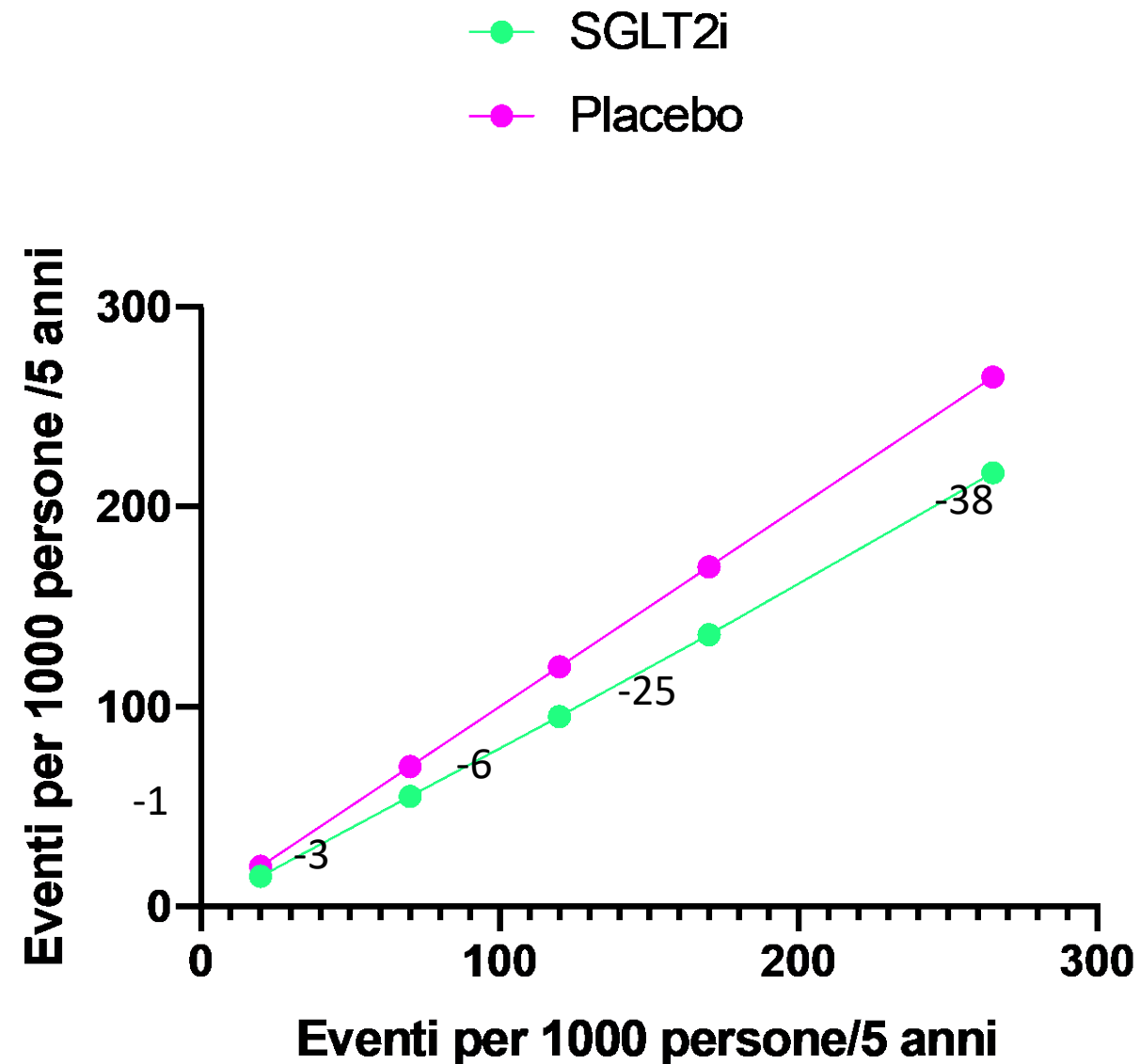
Substrate	ATP yield (Maximum)	Oxygen Usage (atoms)	P/O Ratio (maximum)
Glucose	36	12	3
Pyruvate	16	5	3.2
Palmitate	129	46	2.8
Glutamine	27	10	2.7
3-BOH	35	10	3.5

Plasma β -hydroxybutyrate and lactate concentrations during the 3 h of fasting and the 5 h after meal ingestion at baseline and after acute and chronic empagliflozin administration in patients with T2D and subjects without diabetes





Sodium-glucose cotransporter protein-2 (SGLT-2) inhibitors and glucagon-like peptide-1 (GLP-1) receptor agonists for type 2 diabetes: systematic review and network meta-analysis of randomised controlled trials



Metfomin

↑ glucose
uptake

FFA >
Glucose

SGLT2i

↑ Lipid
Oxidation

Glucose >
FFA

GLP-1RA

↑ Lipid
Oxidation

Glucose >
FFA

