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The association between plasma choline and acute myocardial infarction is modified by potential markers of endogenous PPAR activation

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Funding Acknowledgement: None

Background: Choline is related to lipid handling and higher plasma concentrations have been associated with an adverse cardiovascular risk profile. However, previous studies have suggested that the relationship between plasma free choline and later cardiovascular events may differ according to patient phenotypes.

Purpose: To explore the risk association between plasma choline and later acute myocardial infarction (AMI) according to plasma methylmalonic acid (MMA) or dimethylglycine (DMG). The latter two metabolites are suggested markers of endogenous activation of peroxisome proliferator-activated receptors (PPARs), which are nuclear receptor proteins involved in lipid metabolism.

Methods: Risk relationships were explored by Cox regression among 2232 patients evaluated for suspected stable angina pectoris in the overall population and according to median plasma MMA and DMG.

Results: Baseline plasma choline was related to several cardiovascular

risk factors (Table 1). After median follow-up of 7.3 years, 338 patients were reported with at least one incident AMI. In the overall population, the age and gender adjusted HR (95% CI) for each increment of 1 SD log-transformed plasma choline and AMI was 1.21 (1.08–1.35), $P=0.001$, and the association persisted in multivariate analyses.

In patients with plasma MMA or DMG \geq median, the HRs (95% CIs) were 1.33 (1.16–1.54) and 1.38 (1.20–1.58), respectively, both $P<0.0001$; however no significant relationships were observed between plasma choline and later AMI among patients with either plasma MMA or DMG $<$ median (P interaction <0.008) (Figure 1).

$<$ MEDIAN ($P>$

Conclusion: Among patients with stable angina, plasma choline was related to increased long-term AMI risk among patients with higher plasma MMA or DMG only. This finding potentially reflects increased risk conferred by choline during concomitant endogenous PPAR activation.

Table 1. Baseline characteristics according to plasma choline quartiles

	Quartile 1	Quartile 4	P for trend
Age, years	58 (52–66)	66 (58–73)	<0.0001
Smoking, n (%)	212 (37.9)	153 (27.9)	<0.0001
Diabetes, n (%)	61 (10.9)	85 (15.5)	0.12
Previous acute myocardial infarction, n (%)	200 (35.7)	238 (43.4)	<0.0001
Estimated glomerular filtration rate, mL/min/1.73m ²	96 (87–104)	79 (63–92)	<0.0001
Serum hs-troponin T, ng/L	4 (3–8)	9 (4–17)	0.0002
Serum triglycerides, mmol/L	1.35 (1.00–2.03)	1.60 (1.16–2.25)	<0.0001
Serum apolipoprotein A1, mg/L	1.29 (1.12–1.51)	1.32 (1.17–1.53)	0.01
Statin therapy, n (%)	384 (68.6)	435 (79.4)	0.01

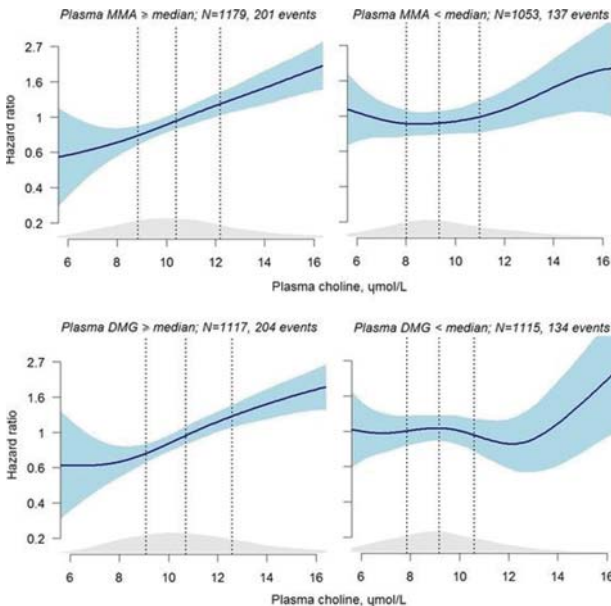


Figure 1