

ORIGINAL RESEARCH COMMUNICATION

# Effects of low- and high-advanced glycation endproduct meals on macro- and microvascular endothelial function and oxidative stress in patients with type 2 diabetes mellitus<sup>1,2,3</sup>

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**Background:** An advanced glycation endproducts (AGEs)–rich diet induces significant increases in inflammatory and endothelial dysfunction markers in type 2 diabetes mellitus (T2DM).

**Objective:** The aim was to investigate the acute effects of dietary AGEs on vascular function in T2DM patients.

**Design:** Twenty inpatients with T2DM [ $\bar{x}$  ( $\pm$  SEM) age: 55.4  $\pm$  2.2 y; glycated hemoglobin: 8.8  $\pm$  0.5%] were investigated. In a randomized crossover design, the effects of a low-AGE (LAGE) and high-AGE (HAGE) meal on macrovascular [by flow-mediated dilatation (FMD)] and microvascular (by Laser-Doppler flowmetry) function, serum markers of endothelial dysfunction (E-selectin, intracellular adhesion molecule 1, and vascular cell adhesion molecule 1), oxidative stress, and serum AGE were assessed. The meals had identical ingredients but different AGE amounts (15.100 compared with 2.750 kU AGE for the HAGE and LAGE meals, respectively), which were obtained by varying the cooking temperature and time. The measurements were performed at baseline and 2, 4, and 6 h after each meal.

**Results:** After the HAGE meal, FMD decreased by 36.2%, from 5.77  $\pm$  0.65% (baseline) to 3.93  $\pm$  0.48 (2 h), 3.70  $\pm$  0.42 (4 h), and 4.42  $\pm$  0.54% (6 h) ( $P < 0.01$  for all compared with baseline). After the LAGE meal, FMD decreased by 20.9%, from 6.04  $\pm$  0.68% (baseline) to 4.75  $\pm$  0.48% (2 h), 4.69  $\pm$  0.51% (4 h), and 5.62  $\pm$  0.63% (6 h), respectively ( $P < 0.01$  for all compared with baseline;  $P < 0.001$  for all compared with the HAGE meal). This impairment of macrovascular function after the HAGE meal was paralleled by an impairment of microvascular function (–67.2%) and increased concentrations of serum AGE and markers of endothelial dysfunction and oxidative stress.

**Conclusions:** In patients with T2DM, a HAGE meal induces a more pronounced acute impairment of vascular function than does an otherwise identical LAGE meal. Therefore, chemical modifications of food by means of cooking play a major role in influencing the extent of postprandial vascular dysfunction.

**Key Words:** Nutrition • diet • glycation • advanced glycation endproducts • oxidative stress • endothelium

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H. Zhou, K. C. Tan, S. W. Shiu, and Y. Wong

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Nephrol. Dial. Transplant., March 1, 2008; 23(3): 927 - 933.

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A. O. Stirban and D. Tschoepe

Cardiovascular Complications in Diabetes: Targets and interventions

Diabetes Care, February 1, 2008; 31(Supplement\_2): S215 - S221.

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A. Stirban, M. Negrean, B. Stratmann, C. Gotting, J. Salomon, K. Kleesiek, and D. Tschoepe

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Diabetes Care, October 1, 2007; 30(10): 2514 - 2516.

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