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AGE content of a protein load is responsible for renal hyperfiltration

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Introduction/ Objectives

Low-protein diet is recommended to slow down chronic kidney disease progression [1,2,3] because each protein load leads to a detrimental glomerular hyperfiltration [4,5,6,7]. All protein preparations used to demonstrate protein-mediated renal hemodynamic effects were rich in Advanced Glycation End Products (AGE) [8,9]. The aim of our study was to evaluate if the AGE content of a protein load is responsible for the protein-induced renal hyperfiltration.

Material and Methods

Ten healthy subjects were assigned to a high-protein (1g/kg) low-AGE (3.000 kU AGE) versus high-AGE (30.000 kU AGE) meal, during imaging sessions performed on two different days. Renal perfusion assessed by PET using [^{15}O] H_2O, renal oxidative metabolism measured by PET using [^{11}C] labeled acetate, and oxygen content using BOLD-MRI, were measured before and 120- minutes after each meal (Figure 1).

Results

Renal perfusion increased significantly (from 3.16 ± 0.55 to 3.80 ± 0.42 mL/min/g (p=0.0002)) after the high-AGE meal whereas it was not modified after the low-AGE meal (from 3.35±0.65 to 3.38±0.53 ml/min/g, p=0.88) (Figure 2). Oxidative metabolism increased significantly after the high-AGE meal (0.3 ± 0.04 vs 0.36 ± 0.08 min^{-1}, p=0.005) compared to the low-AGE meal (0.30 ± 0.02 vs 0.31 ± 0.06 min^{-1}, p=0.76) for both cortices (Figure 2). We did not find any difference in oxygen content between the two diets (Table 1).

Figures

Figure 1: Generation of Time Activity Curves (TAC) from PET MRI data analysis

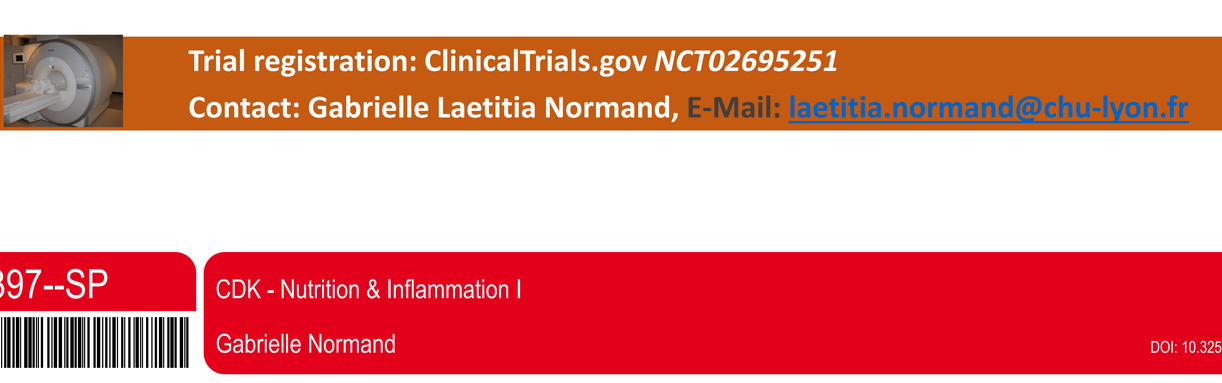

Figure 2: Relative changes induced by either a low-AGE or a high-AGE meal between baseline and post-prandial values. * means p ≤ 0.05

Table

	Low-AGE (n = 9)		High-AGE (n = 10)	
Acquisitions	Baseline	Post prandial	Baseline	Post prandial
^{15}O-water PET (ml/g/min)-	3.35 ± 0.65	3.38 ± 0.53	3.16 ± 0.55	3.8 ± 0.42 *
^{11}C- acetate PET (min^{-1})-	0.30 ± 0.02	0.31 ± 0.06	0.30 ± 0.04	0.36 ± 0.08 *
BOLD-MRI (Cortical R2*)	18.3 ± 1.3	20.4 ± 2.7 *	17.9 ± 1.2	20.1 ± 3.3
BOLD-MRI (medullary R2*)	27.6 ± 3.2	32.2 ± 4.1*	27.1 ± 4.9	32.4 ± 5.7 *

Table 1: Renal functional parameters. * means p ≤ 0.05

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Conclusion

Our results demonstrate that this is not the high protein content of a meal that increases renal perfusion and oxidative metabolism but its high-AGE content. Therefore, this study suggests that prevention of CKD progression should aim predominantly at reducing food AGE content.

Trial registration: ClinicalTrials.gov *NCT02695251*

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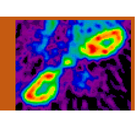

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