Removal of glucoregulatory hormones during haemodialysis and haemodiafiltration

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OBJECTIVES

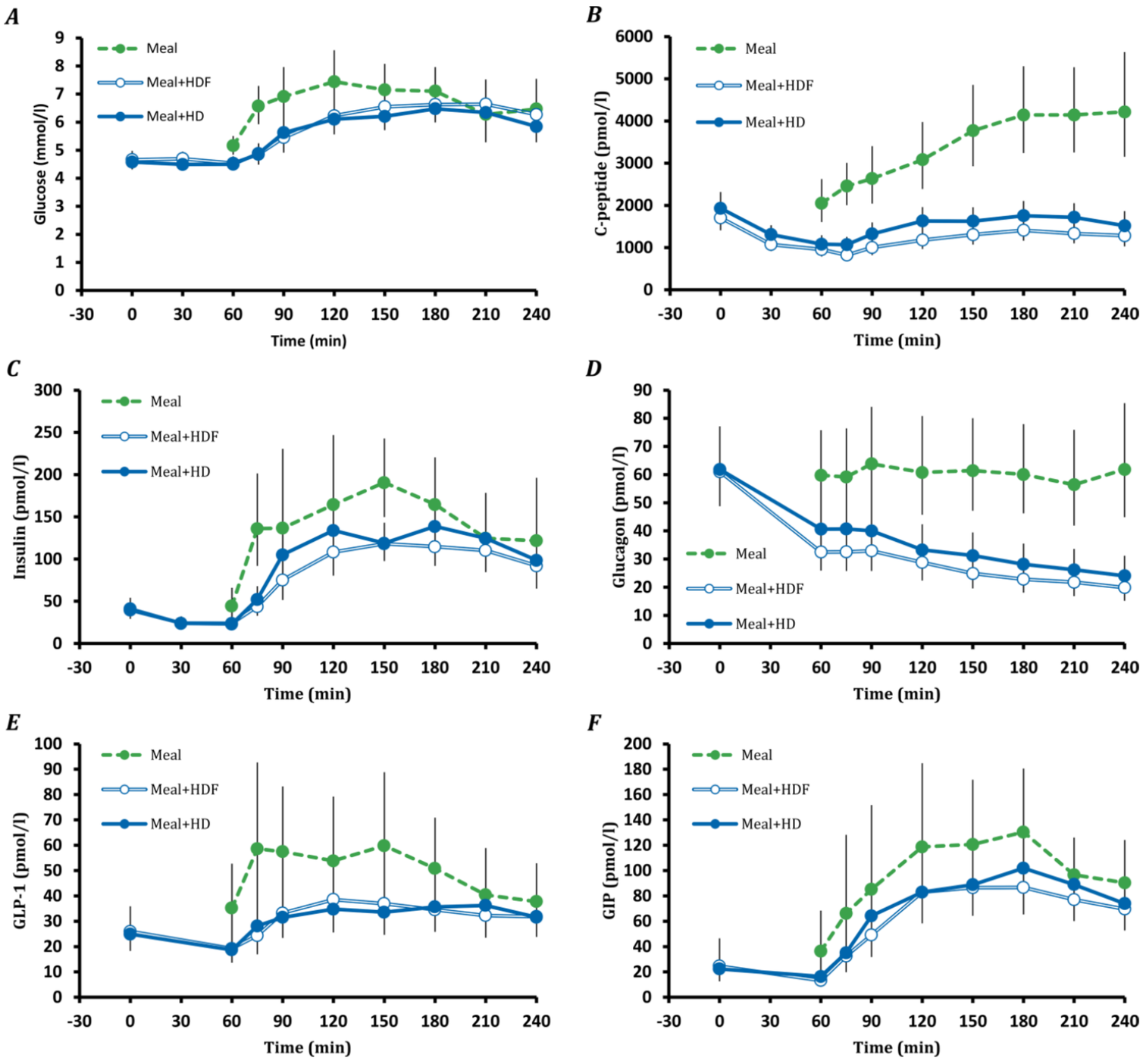
Patients with end-stage renal disease have increased fasting concentrations and disturbed postprandial responses of several glucoregulatory hormones. These findings constitute current or potential targets in the treatment of diabetes. The objective of the present study was to evaluate removal of glucoregulatory peptide hormones during high-flux haemodialysis (HD) and high-volume haemodiafiltration (HDF).

METHODS

10 non-diabetic patients receiving chronic haemodialysis were examined with a standardised liquid mixed meal test one hour into an HD and an HDF. On a third, optional, examination day, the meal test was performed without concurrent dialysis treatment. Plasma and dialysate samples for measurement of insulin, glucagon and the two gut-derived incretin hormones glucagon-like peptide-1 (GLP-1) and glucose-dependent insulinotropic polypeptide (GIP) were collected repeatedly during the examinations. Removal fraction, clearance and the fractional appearance in dialysate were calculated. Results are expressed as mean or geometric mean with confidence intervals (CI).

RESULTS

10 participants with mean fasting plasma glucose of 4.6 (CI: 4.3–4.9) mmol/l completed the meal test during HD, 8 completed the meal test during HDF and 4 the optional meal test without dialysis. Average dialysis blood flow was 334 (CI: 314–354) ml/min with no detectable recirculation. HDF treatments were all high-volume with an ultrafiltration exceeding 20 l/dialysis. All plasma hormone concentrations declined during the first fasting hour for both dialysis modalities ranging from 24.8 to 47.0% ($P<0.043$). A significant removal fraction was detected for the hormones except GLP-1. All hormones had a significant clearance ranging from 44.3 to 136.5 ml/min ($P<0.013$). The fractional appearance of hormone entering the utilised dialysate ranged from 16.6 to 60.0%. A tendency towards higher clearance during HDF was observed for all peptides, significant for GIP ($P<0.022$). The average hormone concentrations following the meal test were lower during dialysis treatments ($P<0.038$).



		Clearance (ml/min)	*Appearance in dialysate (%)*
C-peptide	***HD***	**82** (74 – 86)	**50** (38 – 63)
	HDF	**122** (112 – 131)*	**62** (48 – 76)
Insulin	***HD***	**90** (71 – 98)	**44** (38 – 50)
	HDF	**115** (93 – 138)*	**51** (44 – 57)*
Glucagon	***HD***	**66** (45 – 87)	**28** (22 – 35)
	HDF	**89** (66 – 112)	**49** (42 – 56)*
GLP-1	***HD***	**44** (11 – 78)	**53** (38 – 68)
	HDF	**48** (11 – 86)	**60** (44 – 76)
GIP	***HD***	**102** (82 – 122)	**17** (11 – 22)
	HDF	**137** (114 – 159)*	**30** (24 – 36)*

Figure A-F (left) shows solute concentrations with 95% confidence limits for glucose, c-peptide, insulin, glucagon, GLP-1 and GIP. A liquid mixed meal is ingested at time 60 min.
Table (above) shows clearance from blood and the fractional appearance of hormone in the dialysate at time 60 min for glucagon and time 120 min for c-peptide, insulin, GLP-1 and GIP. * indicates significant difference between dialysis modalities.

CONCLUSIONS

Haemodialysis and haemodiafiltration significantly remove glucoregulatory peptide hormones in non-diabetic dialysis patients. These findings may affect the prescribed dose of present and future antidiabetic treatments in dialysis patients.

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