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# Plasma free amino acid profiles and nutrition proteins in chronic renal failure; effect of dialysis treatment

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**Summary.** A well preserved nutritional status is beneficial in chronically uremic patients for slowing the pace of deterioration of renal function, and delaying the need for dialysis therapy. The purpose of this study was to assess the nutritional profile of 10 patients in a steady state of advanced CRF, and of 15 patients with terminal renal failure immediately prior to their first hemodialysis session (J0), and 7, 14, 45, 60, days post start of dialysis. Patients were 18 to 65 years old with total plasma proteins $\geq 60$g/l. Plasma concentrations of amino acids, nutrition proteins, apolipoproteins A1, and B were evaluated. Non inflammatory reaction was evaluated by determination of alpha-1-acid glycoprotein, and C reactive protein. The data (mean $\pm$ 1 SD) were compared with mean values of 15 healthy individuals.

**Keywords:** Amino acids – Chronic renal failure – Amino acids – Visceral proteins – Inflammatory protein

## Introduction

In chronic renal failure (CRF) different abnormalities of the proteic metabolism have been shown, such as an increase of muscular catabolism produced by acidosis, and a decrease of protein insulin dependent synthesis: Mitch (1988). Moreover the restricted nutritional intake increases this phenomenon: Blumenkrantz (1980), Kopple (1978), Shoenfeld (1983), Wolson (1984).

In addition, it is known that malnutrition occurs commonly in chronically uremic patients. It is the reason why we have undertaken a work to precise the nutritional profile of patients in a steady state of advanced CRF and of patients with terminal renal failure immediately prior to their first hemodialysis session (J0), and 7, 14, 45, 60 days post start of dialysis.

## Material and methods

Two groups of patients were included in the study.

Group 1 consisted of 10 patients, 8 males, and 2 females, in a steady state of advanced CRF. Plasma creatinine was 334 $\mu$mol/l $\pm$ 67 (1SD), and creatinine clearances were from 10 to 30 ml/mn ( evaluated with Cockroft and Gault calculation).

Group 2 consisted of 15 patients with terminal renal failure, 7 males and 8 females. Plasma creatinine was 590 $\pm$ 90 $\mu$mol/l, clearances were from 5 to 10 ml/mn. Hemodialysis were performed using standard dialysates containing bicarbonates, and with cuprophane membranes.

Age range of all patients was 18–65 years. Total plasma proteins $\geq$60g/l.
All patients were excluded with recent infectious syndrom, or with antiinflammatory therapy.

The control group consisted of 15 healthy adults, 8 males, and 7 females.

Analyses were performed on plasma, immediately after the drawing.

Transthyretin (TTR), transferrin (TRF), apolipoproteins A and B were measured by immunoturbidimetric assays, and retinol binding protein (RBP) by radial immunodiffusion (Partigen, Behring Institute, Marburg Germany).

Alpha-1-acid glycoprotein (AAG), C reactive protein (CRP), and haptoglobin were analysed by immunonephelemetric assays.

Total proteins and albumin were measured by commonly used colorimetric methods. The aminograms were performed by automatic ion exchange column chromatography (LC 2000 Biotronik, Germany).

## Results

### *Amino acids (AA)*

Results were reported in Figs. 1 and 2 (mean of each amino acid as a % of reference value).

In steady state CRF patients, the essential AA (EAA) plasma concentrations were found slightly decreased, or more largely decreased as valin and leucin (respectively 206 $\pm$ 59/vs 280 $\pm$ 95 $\mu$mol/l (ref value), and 128 $\pm$ 21/vs 162 $\pm$ 64 $\mu$mol/l $p \leq 0.01$) Non essential AA (NEAA) were in contrast increased, and specially ornithine (148 $\pm$ 55/vs: 82 $\pm$ 38 $\mu$mol/l)citrulline (83 $\pm$ 24/vs 28 $\pm$ 13 $\mu$mol/l), Proline (311 $\pm$ 80/vs 202 $\pm$ 143 $\mu$mol/l), 3 methyl histidine (38 $\pm$ 8/vs 3 $\pm$ 2 $\mu$mol/l and cystine (104 $\pm$ 34/vs 58 $\pm$ 20 $\mu$mol/l).

In predialysis patients at J0, all EAA are reduced, particularly methionine ($p \leq 0.04$), and branched chain AA (BCAA) ($p \leq 0.01$), NEAA are similar to those found in stable CRF. At J7 the concentrations of all AA are superior to those of J0. At J14, alanine, glycine, proline, and at J30 methionine and BCAA are decreasing.

At J60 methionine is back to normal, and almost all AA are in the lower range of normal concentrations. Therefore, the amount of BCAA remains low, and citrulline, and 3-methyl histidine remain high.

### Visceral and inflammatory proteins

In steady state CRF, visceral proteins are in the lower range of normal values, except for RBP whose concentration is very high (97 $\pm$ 27 mg/l/vs 35 $\pm$ 5). Inflammatory proteins are normal.

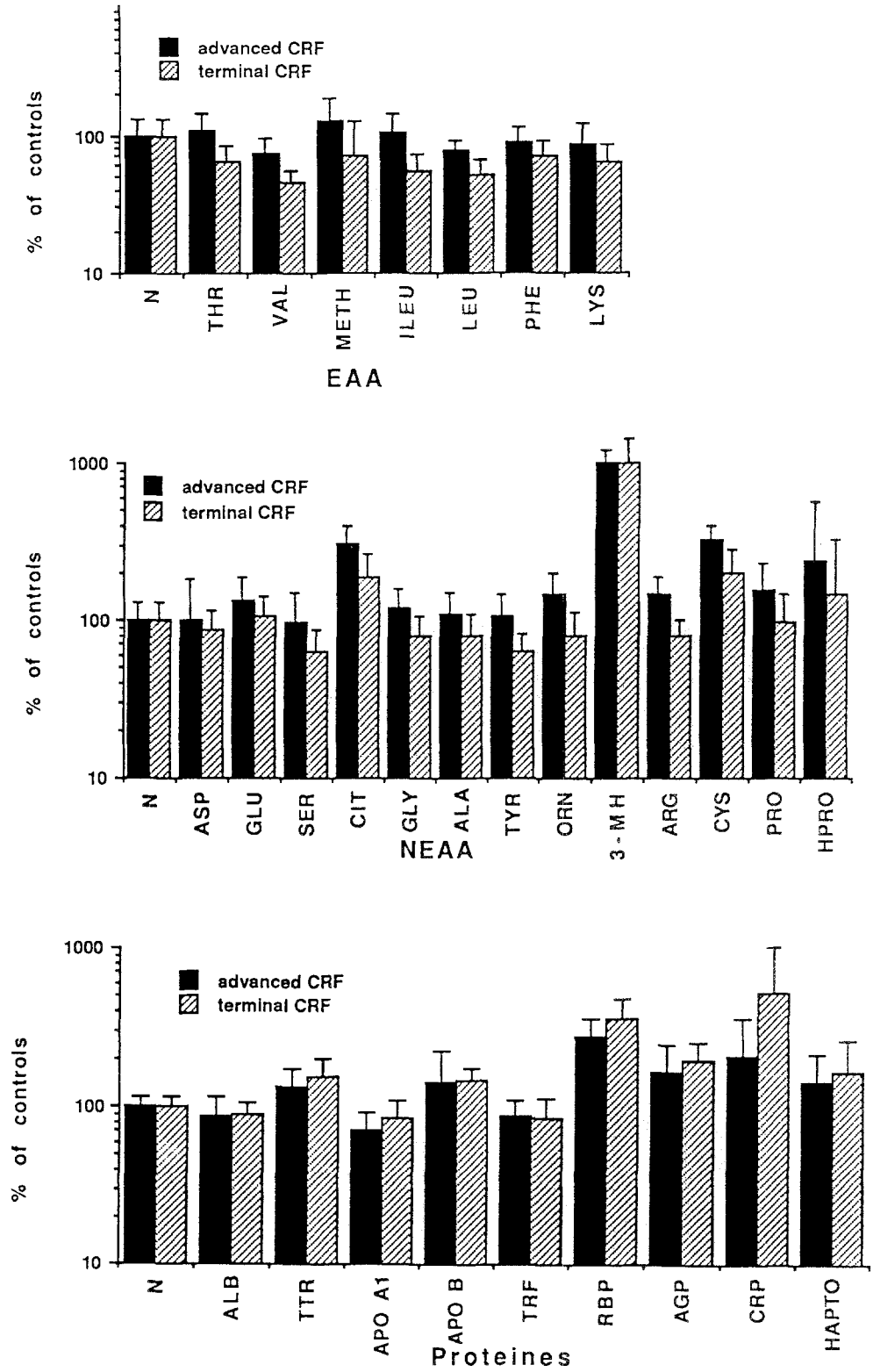


**Fig. 1.** Amino acids and proteins as % of control values in advanced, and terminal CRF (before first dialysis therapy)

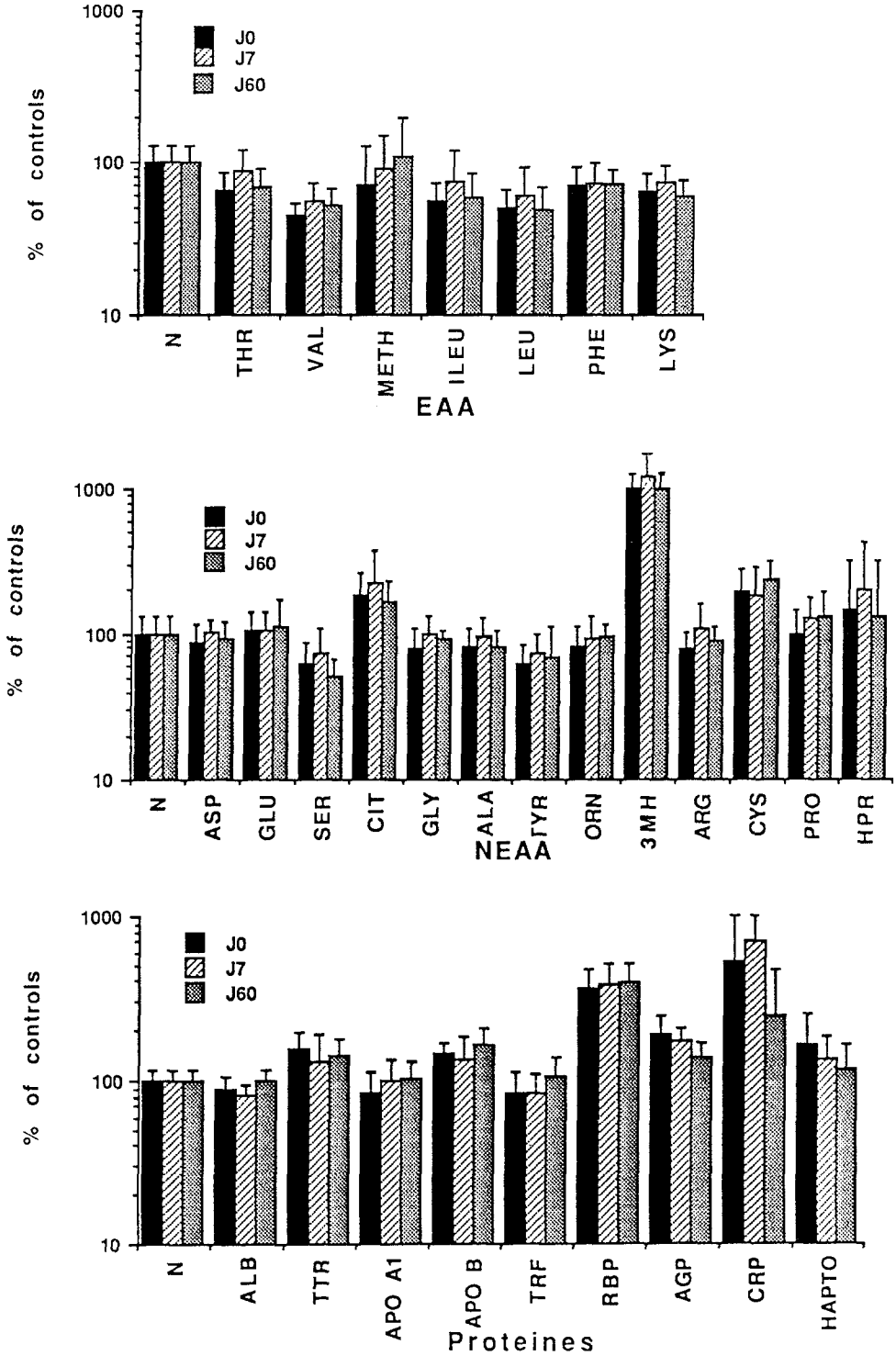


**Fig. 2.** Amino acids and proteins as % of control values in dialysed patients at J0, J7, and J60

In predialysis patients (J0) nutrition proteins are similar to those found in stable advanced CRF, but inflammatory proteins are increased: AAG(1.54 ± 0.45 g/l/vs0.8 ± 0.4), CRP (15.6 ± 23 mg/l/vs 3 ± 3), and RBP is higher than in steady state patients.

At J60 both nutrition and inflammatory proteins have decreased to normal level, but RBP remains elevated.

## Discussion

Our results are in agreement with literature: Alvestrand (1982) Scolari (1983), Tizianello (1983), Druml (1986), Feinstein (1987), and Riedel (1989).

If we compare this study with our previous study realised eight years before: Le Moel (1983), we notice that patients who were being treated by hemodialysis therapy, had values of serum creatinine much more higher than today (1153 μmol/l ±270/vs 590 ± 90).

Amino acids profiles in our present study appear less modified than those found previously.

For the patients in a steady state of advanced CRF, amino acids are for many of them, slightly decreased (EAA) or slightly elevated (NEAA), specially citrulline, ornithine, 3-methyl histidine, cysteine, proline, and hydroxyproline.

These increase are due to urea cycle perturbations, and perhaps also to an elevated proteic catabolism, with a loss of lean body mass.

Inflammatory proteins are normal or subnormal, and nutritional proteins are in the lower range of normal values showing a relatively good general status. In contrast, RBP is very high. The increase of RBP is parallel to the increase of serum creatinine and due to the decrease of glomerular filtration. Renal insufficiency is practically the only clinical situation susceptible to increase the serum level of free RBP: Bernard (1988). This protein cannot be used as a nutritional marker in CRF.

In patients with terminal renal failure, the main differences with patients in a steady state of advanced renal failure are a more important decrease of EAA particularly of BAA, and a decrease of any NEAA such as serine, and tyrosine. Moreover, inflammatory proteins are increased, specially CRP. This may be the reflect of the aggression by renal failure. The concentrations of nutrition proteins are similar to the concentrations in the steady state of advanced CRF patients. Only RBP is more elevated.

During the two months after the start of hemodialysis therapy, amino acids, first increased (J7), then decreased, and at J60, their concentrations were almost the same as at J0. If we consider the valine/glycine, and the tyrosine/phenylalanine ratios, they are different from normal subjects (0.80/vs 1 and 0.63/vs 1.12 respectively). We agree with Scolari (1983). Artificial therapies currently available do not lead to the normalization of the serum aminogram. One of the factors responsible for this could be the aminoacids losses that occur during the artificial therapy: Le Moel (1983). Owing to their molecular size, free amino acids are removed from the patients blood through the membranes.

It is also known that both liver, and kidney are important sources for the synthesis of NEAA, for example serine, which is produced from the two precur-

sors glycine, and hydroxyproline. When the kidney is damaged, the plasma serine levels tend to decrease.

For the inflammatory proteins, at J60 CRP has decreased, but is always high. The increase of inflammatory marker CRP may reflect the adverse effect of dialysis, possibly in relation with membrane.

RBP has no change from J0 to J60 showing the always altered glomerular filtration.

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