



# BIOIMPEDANCE PHASE ANGLE AS A PARAMETER OF THE NUTRITIONAL STATUS FOR HEMODIALYSIS PATIENTS



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## INTRODUCTION AND AIMS

There are sufficient evidences of the necessity to monitor the nutritional status of dialysis patients. For this purpose there are special methods of physical examination, laboratory markers and questionnaires. Additional procedure for diagnostic the violations of nutritional status in screening mode is the bioimpedance analysis, which is a direct method and almost free from human errors. Phase Angle (PA) is the most accurate parameter in assessing the nutritional status by bioimpedance, because its value is determined by the potential of cell membranes and, therefore, provides insight into the nutritional status at the cellular level. The aim of this study was to determine the adequacy of the assessment of nutritional status for hemodialysis (HD) patients by using the PA.

## METHODS

Total 66 HD patients were included in the study. The mean age was  $60 \pm 14$  years, mean duration of renal replacement therapy was  $68 \pm 57$  months. Bioimpedance measurement was performed on phase-sensitive bioimpedance analyzer NutriGuard-M (Data Input GmbH), at the start of the HD and 15 minutes after the HD. PA was determined at a frequency of 50 kHz and analyzed in each bioimpedance dimension. The upper arm muscle area and triceps skinfold were measured before HD. Serum albumin, phosphorus, C-reactive protein (CRP) were determined before dialysis as biochemical markers of nutritional status. Also the calculation of the protein catabolic rate (nPCR) was performed.

## RESULTS

The following average values of the PA were obtained: before HD  $5,2 \pm 1,2^\circ$ , after HD  $5,9 \pm 1,2^\circ$ . There was an inverse correlation between the PA and the patient's age (before HD  $r = -0,65$ ,  $p < 0,001$ ; after HD  $r = -0,60$ ,  $p < 0,001$ ; Fig. 1) and CRP (before HD  $r = -0,31$ ,  $p < 0,05$ ; after HD  $r = -0,26$ ,  $p < 0,05$ ; Fig. 2). Also revealed positive direct correlation between the PA and the serum albumin level (before HD  $r = 0,43$ ;  $p < 0,001$ , after HD  $r = 0,56$ ,  $p < 0,001$ ; Fig. 3), serum phosphate level (before HD  $r = 0,35$ ,  $p < 0,01$ ; Fig. 4), nPCR (before HD  $r = 0,41$ ,  $p < 0,001$ ; after HD  $r = 0,27$ ,  $p < 0,05$ ; Fig. 5) and the upper arm muscle area (before HD  $r = 0,31$ ,  $p < 0,05$ ; after HD  $r = 0,26$ ,  $p < 0,05$ ; Fig. 6). Stepwise regression analysis with the exception of the variables confirmed the independent effect of age, CRP, serum albumin, nPCR and upper arm muscle area to the level of the PA.

Fig 1. Correlation between the PA and the patient's age

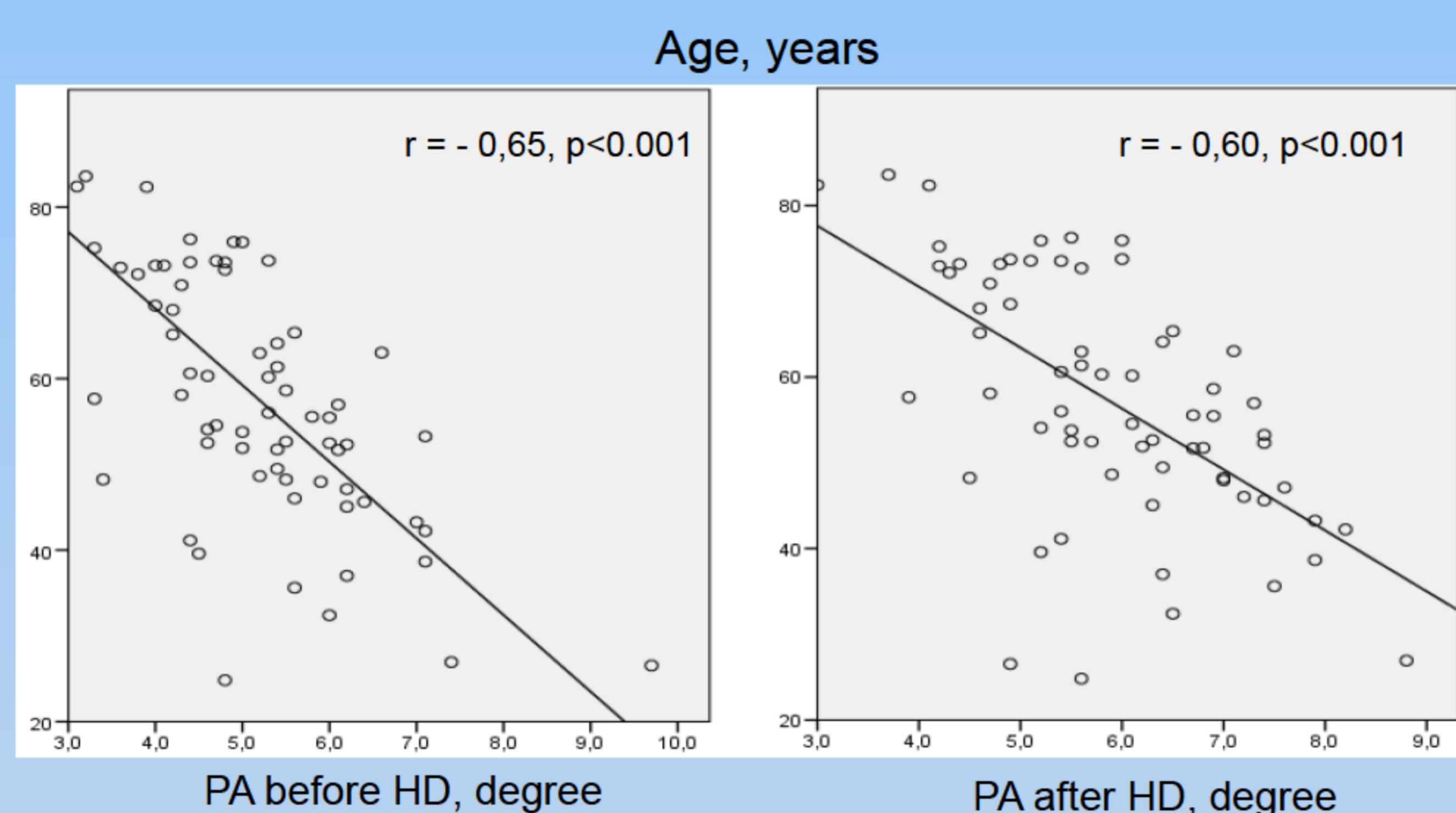


Fig 2. Correlation between the PA and CRP

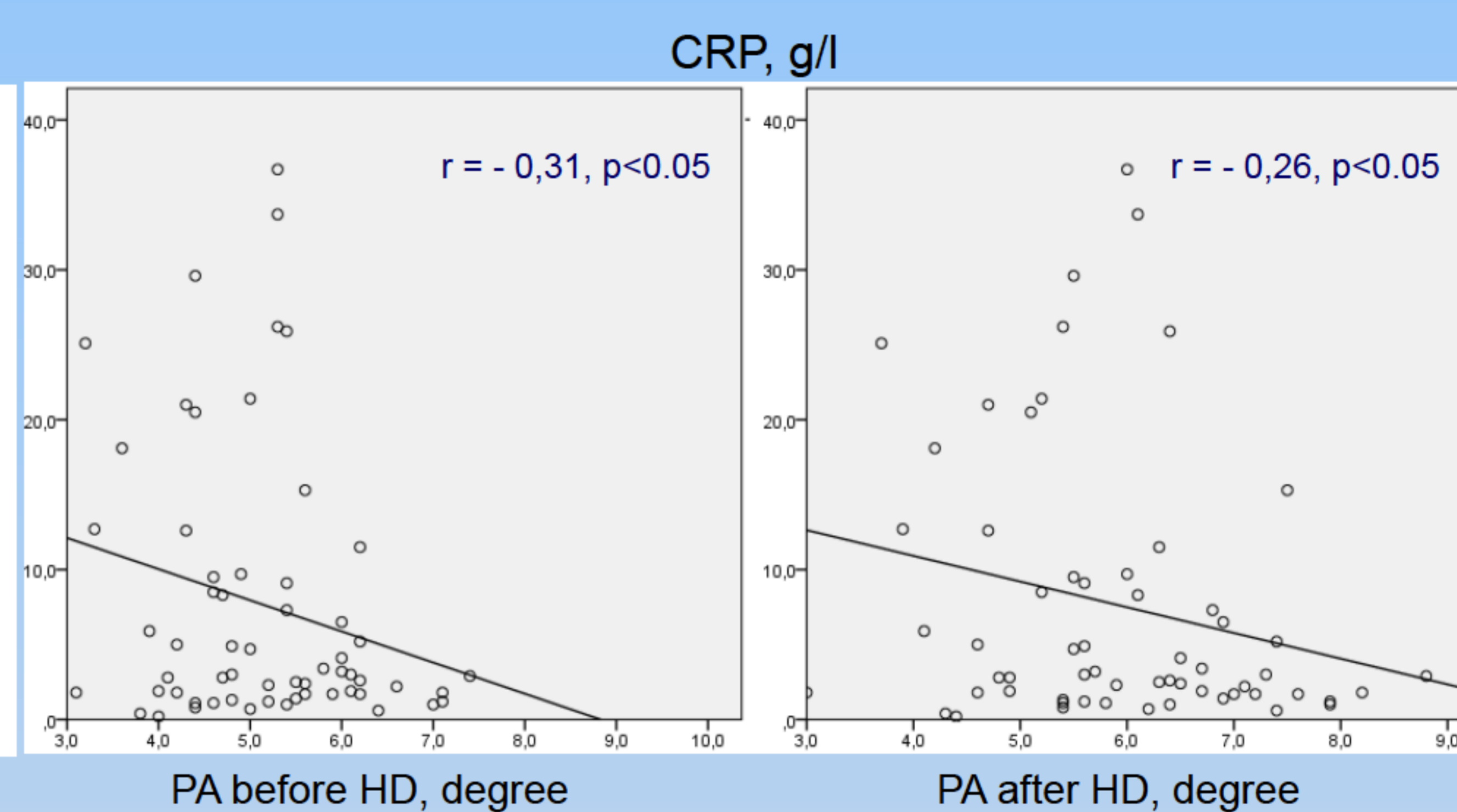


Fig 3. Correlation between the PA and serum albumin

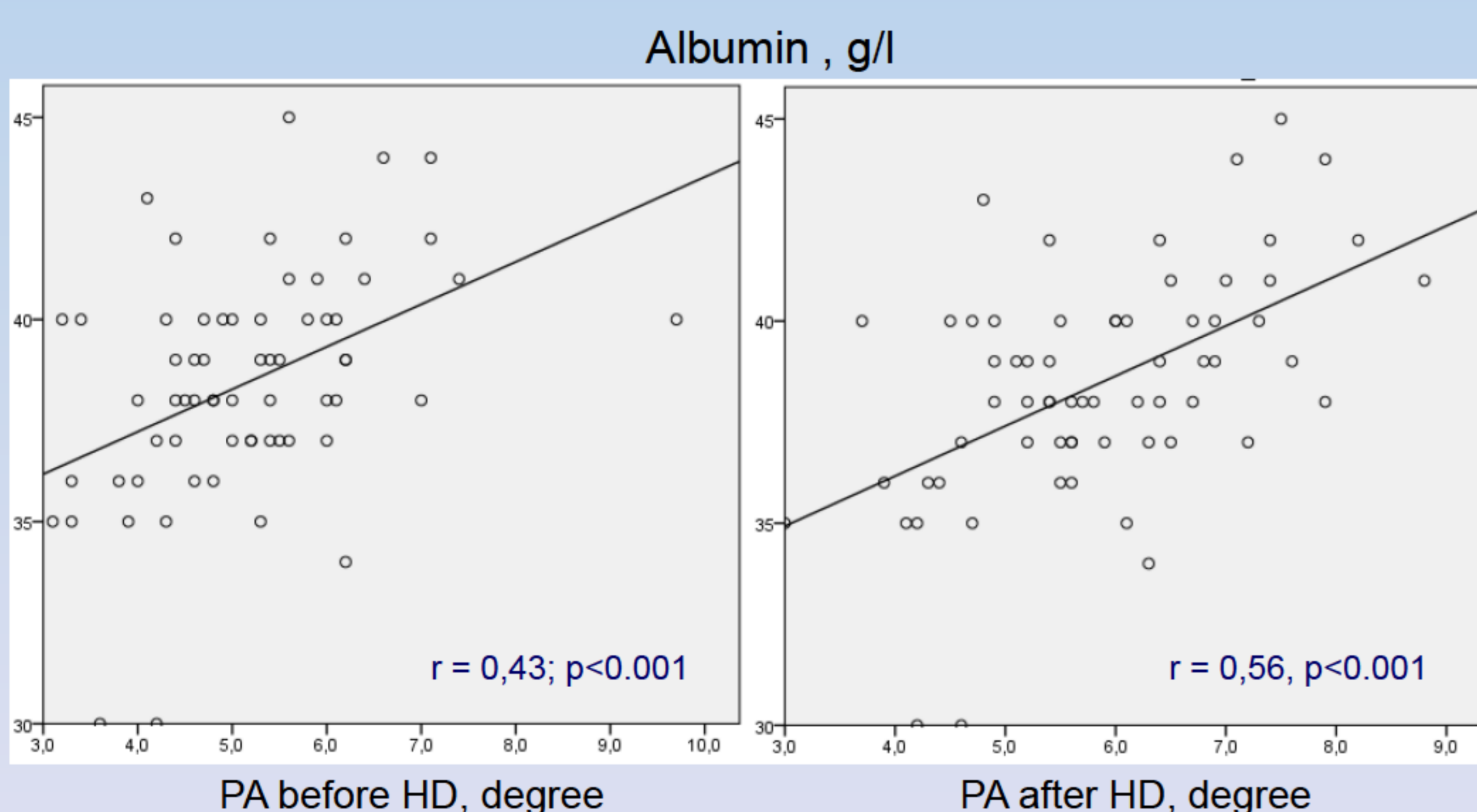


Fig 5. Correlation between the PA and nPCR

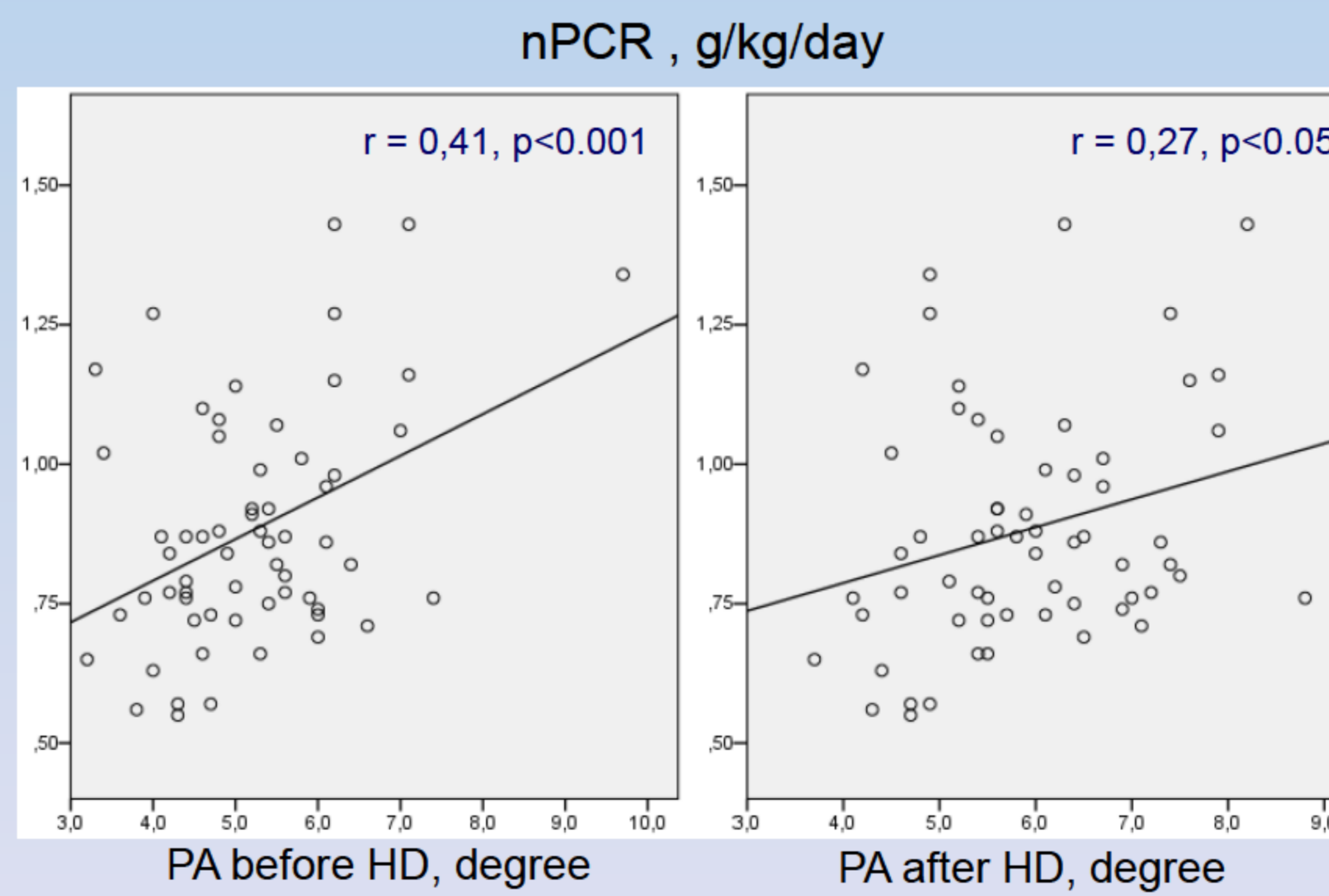


Fig 4. Correlation between the PA and serum phosphate P, mmol/l

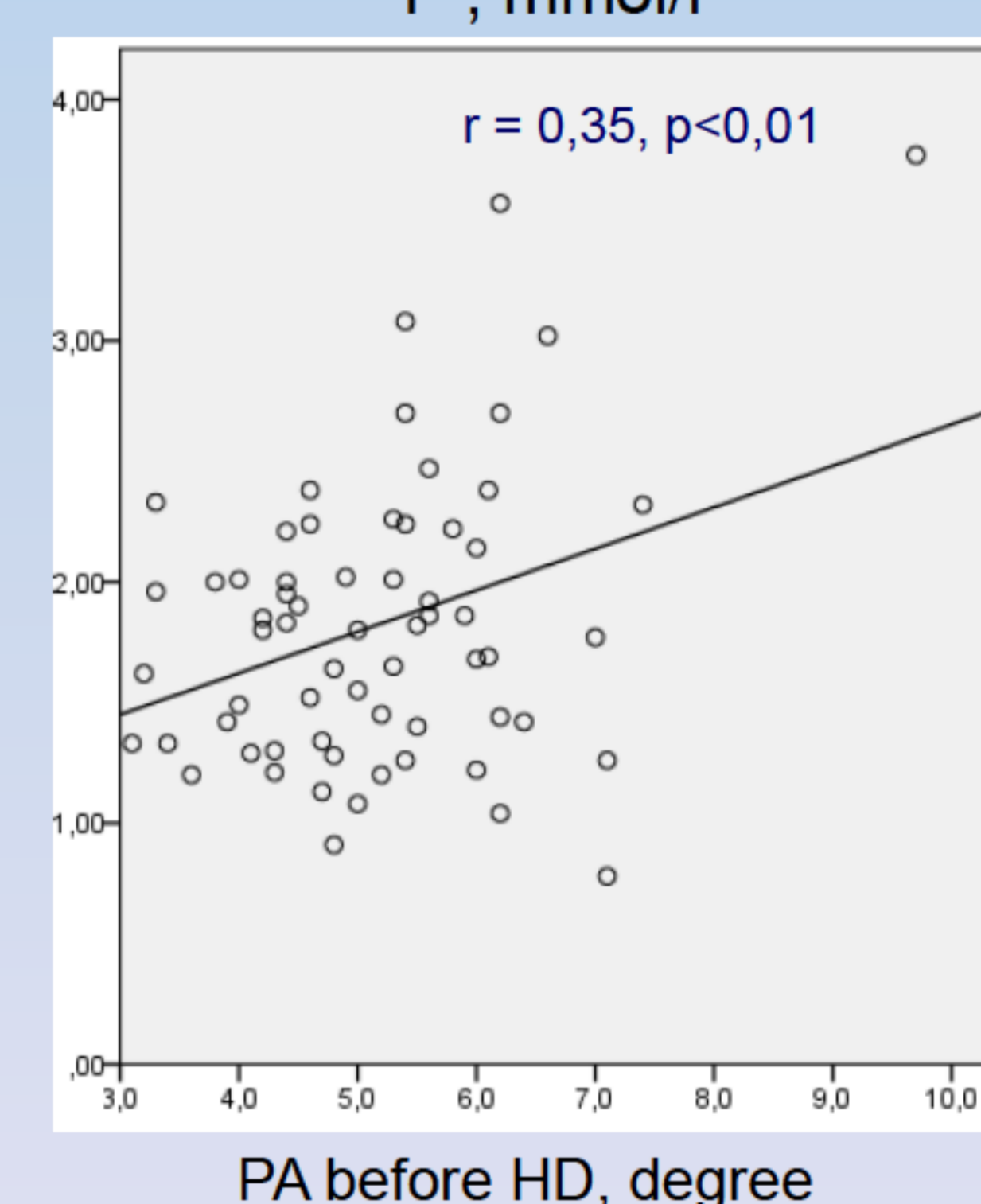
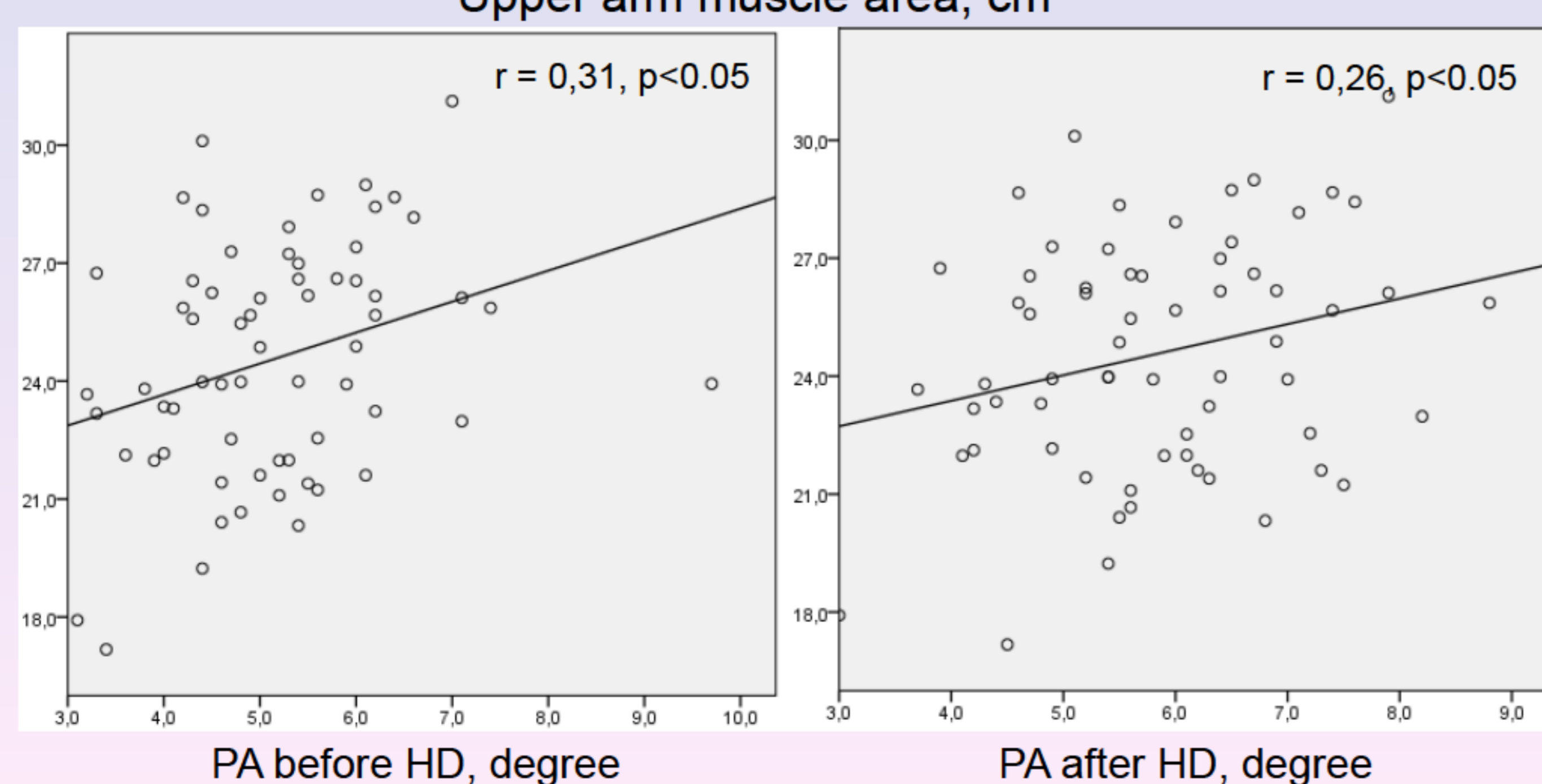


Fig 6. Correlation between the PA and upper arm muscle area



## CONCLUSIONS

Bioimpedance PA is appropriate parameter in the integrated assessment of the nutritional status for hemodialysis patients and it can be used as a screening marker of the nutritional disorders.

