

# Is there a different volume distribution in diabetic haemodialysis patients?

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Volume overload (VO) is easily measured by bioimpedance spectroscopy (BIS) in everyday dialysis. A technique to measure absolute blood volume (aBV) has not been available in clinical practice so far. Recently, we presented a simple method to determine absolute blood volume during routine haemodialysis (HD) sessions (1). The combination of both techniques allows comparing the volume distribution with regard to different patient groups in an everyday clinical setting, for example diabetics and non-diabetics.

### Method:

This is a post-hoc analysis of a study (1) that was conducted in **30 stable HD patients**. Absolute blood volume was determined by indicator dilution method using an on-line infusate bolus which was administered immediately after the beginning of the dialysis session before ultrafiltration was started. 240 mL of ultra-pure dialysate were infused as post-dilution by the bolus function of a commercial dialysis machine (5008, FMC). The resulting increase in relative blood volume (RBV<sub>post</sub>-RBV<sub>pre</sub>) was measured by the ultrasonic blood volume monitor (BVM) incorporated in the dialysis machine. Absolute blood volume was calculated as:

$$\text{absolute blood volume (in mL)} = \frac{\text{bolus volume (240 mL)} \times 100 \%}{\text{increase in relative blood volume in \%}}$$

Absolute blood volume data were normalized for body mass (in mL/kg). Before treatment, actual volume status was also assessed by BIS using the body composition monitor (FMC).

In **17 diabetic** and **13 non-diabetic** HD patients

**absolute blood volume was almost identical:**

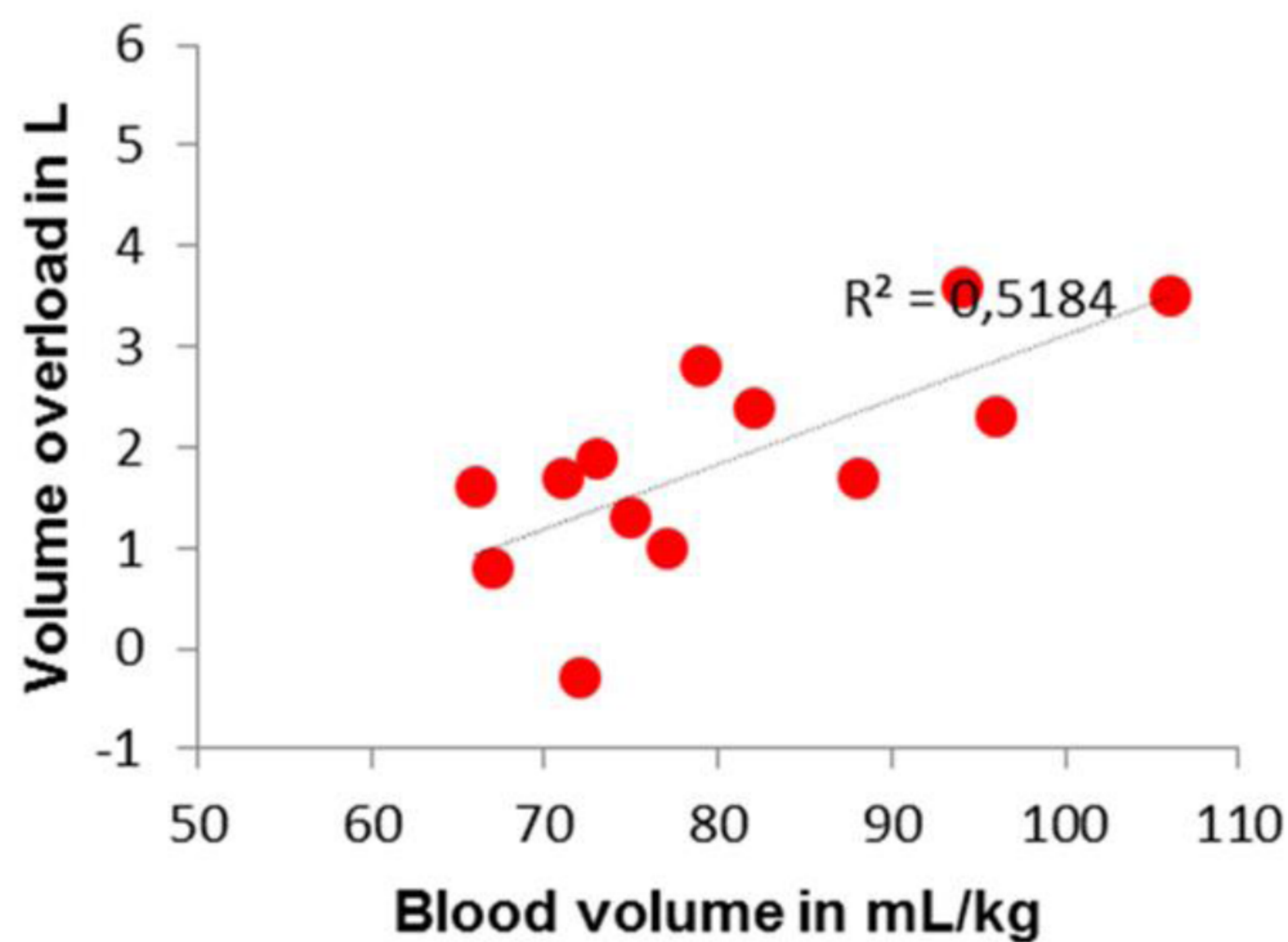
**79.9 ± 13.6 mL/kg**      **80.5 ± 12.2 mL/kg**

**but volume overload was significantly higher in diabetics (p = 0.048):**

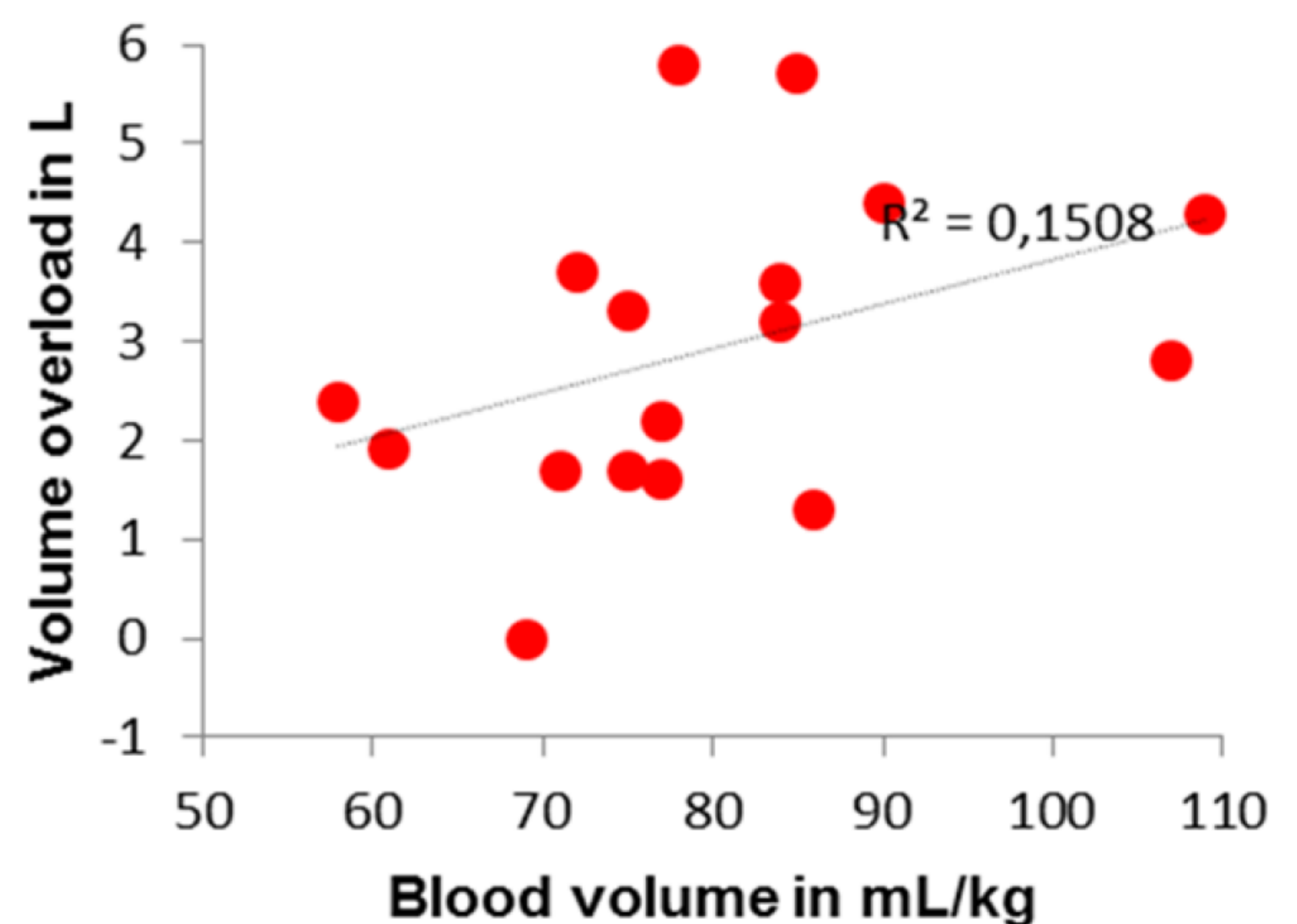
**2.9 ± 1.6 L**      **1.8 ± 1.1 L**

The age was similar (75.5 ± 12.5 vs. 75.9 ± 8.4 years) in both groups, body weight was higher in diabetics (87.3 ± 16.2 kg vs. 72.6 ± 16.4 kg, p=0.021), but there were no significant differences in body mass index, lean tissue index, and fat tissue index. Total body water and extracellular volume were higher in diabetics, but normalized for body mass there were no differences.

In **non-diabetic** HD patients there was a **significant correlation (p = 0.0055)** between **absolute blood volume and volume overload measured by BIS (r = 0.72)** :



In contrast, **absolute blood volume and volume overload did not correlate in diabetic patients (r = 0.39, p = 0.12):**



**IN CONCLUSION**, diabetic HD patients seemed to be more volume overloaded without a correlating increase in absolute blood volume. A different extracellular volume distribution in diabetics might lead to underestimation of their blood volume. If we try to completely remove the excess volume, blood volume may be reduced below a critical threshold, which could contribute to frequent intradialytic morbid events (IME) in diabetics, in addition to diabetic neuropathy. Until we have more data in this matter, we should rather avoid complete removal of volume overload in IME-prone diabetics.

Current on-line haemodiafiltration machines equipped with a blood volume monitor and an online bolus function can be used to determine absolute blood volume in clinical practice. The described method is an additional tool to study distribution and dynamics of fluid between different compartments. Further studies will contribute to a better understanding of the volume distribution, and prevent volume imbalances during the HD sessions.

1. Kron J, Schneditz D, Leimbach T, Aign S, Kron S: A simple and feasible method to determine absolute blood volume in hemodialysis patients in clinical practice. Blood Purif 2014; 38: 180-187.