

## ORIGINAL ARTICLE

# Association of Intradialytic Hypertension and Dietary Elements: A Case-Control Study

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## ABSTRACT

**Background:** Intradialytic hypertension (IDH) is defined as a rise in blood pressure during or immediately after hemodialysis that is associated with increased mortality in these patients. This study aimed to evaluate the association between IDH and the nutritional intake of trace and micromineral elements in maintenance hemodialysis patients.

**Methods:** Patients with chronic renal failure treated with maintenance hemodialysis were assessed in this case-control study. The participants who had IDH were selected as the case group. The Food Frequency Questionnaire (FFQ) was used to collect nutritional data; and then, the diets of the two groups were analyzed. Totally, 23 patients with IDH and 23 without IDH were included in the analysis.

**Results:** Although there was no significant difference in daily calorie intake between the two groups, the mean dietary intake of sodium, calcium, phosphorus, and total fat was significantly higher in the IDH group than the control group ( $p < 0.05$ ). In the group with IDH, the phosphorus intake was higher than the recommended amount, while the control group consumed significantly less oral phosphorus.

**Conclusion:** Advising limiting oral phosphorus and sodium consumption along with low-fat diet may help to reduce blood pressure in IDH patients and the subsequent mortality.

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## Introduction

The incidence of chronic kidney disease (CKD) and end-stage renal disease (ESRD) is rising worldwide. Patients with ESRD finally need peritoneal dialysis or hemodialysis before a kidney

transplant. Hemodialysis has serious complications such as intradialytic hypotension with an incidence of 5-40% (1), anaphylactoid reaction, transient ischemic events or stroke, and hemostasis problems (2). Although hemodialysis is life-saving for renal

effect of other elements of the diet like potassium, calcium, and magnesium to understand the impact of diet on blood pressure; because they may affect each other. For example, high sodium intake can alter calcium excretion by increasing intravascular volume, which is associated with an increase in SBP (24, 25). However, Stamler et al. and Weaver et al. showed small benefits of lower-sodium intakes in controlling BP (10, 26); it could be due to the effects of the minerals on each other and their different effects which are not easily discernible.

In this study, serum phosphorus level was higher in the IDH group than in the control group; however, it was not significant. Likewise, dietary phosphorus was significantly higher in the IDH group than in the control group. However, the blood level of calcium was not significantly different; as dietary calcium intake was significantly higher in the IDH group. Higher phosphorus intake in combination with higher dietary calcium intake is associated with calcium deposition and vascular stiffness in IDH patients, and it is an independent risk factor for resistant hypertension during hemodialysis and is associated with increased mortality (27). This relationship could be due to an increase in fibroblast growth factor-23 (FGF-23) levels, which are directly related to hemodialysis patients' mortality. FGF-23 increases the urinary phosphate excretion and inhibits renal production of 1,25-dihydroxy vitamin D, thus helping to reduce hyperphosphatemia in patients with kidney disease (28). Evaluation of vascular stiffness and calcification in IDH patients can help to clarify this relationship. Although a previous study showed that higher phosphorus intake is associated with lower blood pressure levels in hemodialysis patients, these potential benefits appear to be limited to nutritional phosphorus from dairy products (29).

There is a limitation in the consumption of dairy products in hemodialysis patients; therefore, phosphorus intake is not probably associated with reducing blood pressure in these patients. The relationship between the source of phosphorus intake and hypertension in dialysis patients should be investigated in future studies. Effective removal of phosphorus by hemodialysis depends on its biphasic excretion (rebound of plasma level after reaching nadir level) in the body, limitation of oral phosphorus intake, and elimination of protein malnutrition which increases the absorption of dietary phosphorus (30, 31). Therefore, patients with IDH are recommended to limit the consumption of dietary phosphorus; while improving malnutrition and increasing albumin levels, because serum albumin levels have an inverse association with high diastolic blood pressure and mortality in dialysis patients (32, 33).

Vitamin D has the potential effect on controlling blood pressure in several ways; inhibiting the Renin-Angiotensin-Aldosterone-System (RAAS), regulating the vascular tone, reducing the impact of glycation end products on endothelium, improving the effect of nitric oxide (NO) system, and increasing the production of prostacyclin (34-36). Vitamin D deficiency is prevalent in dialysis patients due to increased FGF-23 and decreased renal tissue function, so previous studies have supported using vitamin D supplements in these patients (36). The dietary vitamin D intake was significantly lower than the recommended amount in both groups in the current study. It was remarkable that although dietary vitamin D intake in the IDH group was higher than the control group, serum vitamin D levels were lower in the IDH group, so patients with IDH may have lower vitamin D absorption, or vitamin D production is reduced due to higher phosphorus intake and subsequent increased FGF-23. Notably, none of the patients received vitamin D supplementation as 25 hydroxyvitamin D3 (37). The mean of fat intake in the group with IDH was significantly higher than the control group. Several studies demonstrated higher intakes of total fat, saturated fat, and cholesterol to be risk factors for hypertension, and low-fat dairy foods to be associated with lower blood pressure (38, 39). The most important limitation of our study was the lack of correct answers about the food consumed by the patients at the time of completing the questionnaire. And the most important strength was that we investigated for the first time the relationship between the consumption of trace elements and minerals in the diet of patients under hemodialysis with IDH.

## Conclusion

The present study showed that IDH patients consumed more dietary sodium, phosphorus, and fat; while limiting the consumption of these nutritional elements is recommended. The above findings suggest that adherence to a diet based on the DASH in dialysis patients with IDH is lower than in patients without IDH. Therefore, recommending the DASH to IDH patients could be an effective treatment strategy for reducing the risk of cardiovascular events.

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### Authors' Contribution

P.M. Mahmoudi and M. Shafiee were responsible for designing and interpreting data and writing the manuscript. M. Ekramzadeh, S.A. Zomorodian and M. Ranjbar Zahedani contributed to writing the manuscript, and E.A. Dehkordi analyzed the data. M.H. Shirazi contributed to the data acquisition and drafting of the manuscript. All authors read and approved the final manuscript.

### Conflict of Interest

None declared.

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