Vegetarian Diet Alternated With Conventional Low-Protein Diet for Patients With Chronic Renal Failure

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Objectives: A dietary management program, consisting of the alternation between a vegetarian low-protein diet (VD) and an animal-based conventional low-protein diet (CLPD), aims to increase foods choices and to improve compliance with dietary prescriptions, psychologic aspects, and the quality of life of renal patients. The present study investigates the subjective effects and the practical consequences of this dietary approach in patients with chronic renal failure.

Methods: Twenty patients (13 men, 7 women, 53 ± 10 years) with chronic renal failure (creatinine clearance, <45 mL/min) were given the possibility to alternate (at their own convenience) the CLPD with the VD. After a follow-up period of 9 ± 8 months, biochemistries were drawn and a questionnaire was mailed to asses the patients' subjective remarks about the proposed dietary management.

Results: Most of the patients (90%) favorably accepted this dietary schedule because it provided more variety, it was less repetitive, and it was more suitable for those leading an active life. In many cases, patients reported that their quality of life and some psychologic problems were improved, as well as the palatability of the diet. On this dietary regimen, monthly demands of starch-made foods can be reduced and, hence, the social and/or individual costs. These features contributed to better compliance with dietary prescriptions. Nutritional parameters did not change significantly, and a decrease in total and low-density lipoprotein cholesterol levels were observed.

Conclusions: Our observations suggest that alternating between an animal-based CLPD and a vegetable-based VD can provide a useful dietary management for renal patients, giving them more chances for long-lasting dietary compliance.

LOW-PROTEIN DIETS play a pivotal role in the conservative treatment of patients with chronic renal failure.[1,2] Protein-restricted diets improve uremic symptoms because they reduce the levels of uremic toxins, most of which come from protein metabolism. A low-protein diet also favorably affects several specific complications of renal failure, including metabolic acidosis, renal osteodystrophy, secondary hyperparathyroidism, and hypertension.[1-3] These important clinical effects overcome the evidence, although controversial, that low-protein diets can slow the progressive loss of renal function.[4-6] However, the fear of malnutrition still hampers protein restriction, despite no evidence that protein depletion exists, provided acidosis is corrected and an adequate energy intake is supplied.[7]

In fact, with adequate dietary management, patients with chronic renal failure eating a low-protein diet are in neutral nitrogen balance and can maintain normal levels of both serum proteins and anthropometric estimates of lean body mass.[8] It is well known that dietary protein restriction can be used safely if patients are monitored carefully[7] and that an adequate calorie supply is critical for renal patients on a low-protein diet.[8] Hence, good compliance with dietary recommendations must represent the major goal pursued to obtain good clinical results.

A conventional low-protein diet (CLPD) generally requires using starch-made foods as the main energy source. They are protein-free substitutes for normal bread, pasta, macaroni, and biscuits, which are made by using gluten-free

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ingredients and are composed almost completely of carbohydrates (starch) with a very negligible protein content. Unfortunately, these artificial foods are poorly palatable, expensive, and difficult to eat, especially when away from home.[1] These are crucial points because an inadequate intake of starch-made products is the main cause of low-energy supply, leading to loss of fat and of lean body mass.[2]

To overcome these drawbacks, we suggested a natural, vegetable-based, low-protein (0.7 g/kg of body weight), high energy (30 to 35 kcal/kg) diet (vegetarian diet [VD]), which uses a cereal-legume combination to cover the essential amino acids requirements. Unlike the CLPD, the VD needs iron and vitamin B_{12} preparations because meat or fish are excluded.[9] This diet satisfies the energy requirement to maintain a low nitrogen and phosphorus intake because the energy/protein and the energy/phosphorus ratio are higher in many foods of plant origin than they are in animal-derived foods. The intake of cereals and legumes[9,10] gives an essential amino acid supply very close to that supplied by the CLPD[9] and covers the recommended dietary allowances.[9]

In addition, the vegetarian nature of the diet can exert more favorable effects on lipid metabolism,[11] on acid-base status,[12] on glomerular hemodynamics,[13,14] and on systemic hypertension.[15] Actually, in our experience, the VD achieved results comparable with the CLPD[9] and this was recently confirmed by other investigators.[16]

However, we have appreciated that avoiding all foods of animal origin also made this diet invariable and too repetitive, and the temptation to eat more animal-protein dishes increased. In our opinion, the obligate limitation of food choices, when prolonged for a long time, is the first factor that reduces compliance with dietary prescriptions.

With the aim to offer to the patients a more varied and adaptable dietary treatment, we proposed the possibility of alternating the CLPD with the VD. In the present study, we investigate the subjective effects and the practical consequences reported by patients with chronic renal failure who underwent this dietary management.

Patients and Methods

Twenty consecutive patients (13 men, 7 women, 53 ± 10 years) affected by chronic renal failure (creatinine clearance, <45 mL/min) on conservative treatment were studied. They were shifted from one low-protein diet to a dietary schedule that consisted of the alternation between the animal-based CLPD and the vegetable-based VD. We let patients choose the type of alternation by their own convenience (ie, it was not imposed by the physician or by the dietitian), with the only warning being not to mix the 2 diets in the same day. The main features of the CLPD and of the VD are summarized in Table 1.

For patients' convenience, they were given 2 booklets, 1 for the CLPD and 1 for the VD. Each booklet explained the general guidelines and the features of the diet and included sheets describing 10 different daily menus (breakfast, lunch, and dinner) to give patients and partners practical examples and suggestions for meals.

After at least 3 months, a short questionnaire of 10 items (Fig 1) was mailed to each patient to assess their opinions about the proposed dietary management and its effects on every day life.

Before and at the end of the follow-up period (3 to 30 months, 9 ± 8 months) creatinine clearance levels and serum levels of albumin, total

Table 1. Composition and Foods Choices of the CLPD and of the VD

Composition	CLPD	VD	Food Choices	CLPD	VD
Proteins (g/kg bw)	0.6	0.7	Starch-made foods	Yes	No
Phosphorus (mg/kg bw)	8.0	10	Meat, fish, poultry	Yes	No
Potassium (mmol/kg bw)	0.8	1.1	Bread, pasta, cereals	No	Yes
Energy (Kcal/kg bw)	>35	>35	Legumes	No	Yes
Carbohydrates (%)	61	57	Vegetables	Yes	Yes
Fats (%)	31	34	Fruits	Yes	Yes
Proteins (%)	7	8	Milk, dairy products	No	No
			Supplements		
			Calcium carbonate	Yes	Yes
			Iron, vitamin B_{12}	No	Yes

Abbreviation: bw, body weight.

1) Is the dietary regimen based on the alternation between the conventional and the vegetarian low-protein diet, preferable in respect to only one type of low-protein diet ?

If ***YES*** ***(90)*** Why ?

a As a whole, the diet is more varied and not too repetitive **(75)**

b It is more suitable for leading an active life **(45)**

c I dislike eating starch-made foods **(5)**

d The starch-made products are expensive **(30)**

If ***NO*** ***(10)*** Why ?

a I dislike eating vegetal dishes

b I want not to avoid meat dishes

c Intestinal discomfort **(5)**

d Other.....**(5)**

2. Which schedule of alternation between conventional and vegetarian low-protein diet do you prefer ?

a on alternate days **(20)** **b** week-days / holidays **(20)** **c** on alternate weeks **(40)** **d** occasional **(20)**

In the case of alternation between conventional and vegetarian low protein diet,

3. the workload for the people who usually do the cooking is
a increased **(35)** **b** unchanged **(45)** **c** lowered **(20)**

4. the quality of life, the familial and individual freedom are
a improved **(60)** **b** unchanged **(30)** **c** worsened **(10)**

5. the real compliance to dietary prescriptions is
a improved **(50)** **b** unchanged **(45)** **c** worsened **(5)**

6. the feeling to be " ill " or "different from the others" is
a reduced **(50)** **b** unchanged **(45)** **c** worsened **(5)**

7. the individual or familial total cost is
a reduced **(30)** **b** unchanged **(60)** **c** increased **(10)**

8. Problems of the everyday life (food shopping, cooking or to have a meal out)
a reduced **(25)** **b** unchanged **(55)** **c** worsened **(20)**

9. As a whole, the taste and the palatability of the diet are
a improved **(55)** **b** unchanged **(35)** **c** worsened **(10)**

10. The possibility of eating normal bread or pasta for some days
a improves **(75)** **b** does not change **(15)** **c** worsens **(10)**
the compliance with starch-made products

Figure 1. Questionnaire sheet. Results are expressed as percentage values in parentheses.

proteins, lipids, electrolytes, and hematocrit were measured, as well as urinary protein and urea excretion. Energy intake and its adequacy to energy requirement have been evaluated by dietary interview and by body weight monitoring. The overall compliance with dietary protein prescriptions has been assessed by calculation of protein catabolic rate by using the Maroni's formula.[17] Clinical characteristics of the studied patients are listed in Table 2.

All the data are expressed as mean ± standard deviation. Results of the questionnaire are expressed as percentage of the 20 patients. Statistical analysis was performed by using the Student *t* test for paired data. Differences were considered significant when $P < .05$.

Results

All 20 patients studied returned the questionnaire. The analysis of the patients' answers are reported on the questionnaire sheet and are expressed as percentages (Fig 1). Eighteen of 20 patients (90%) enjoyed this alternating dietary regimen because it made the diet, as a whole, more varied, not too repetitive, and more suitable for leading an active life.

Only 2 patients disliked it, one because of intestinal discomfort during the VD caused by the exclusive use of vegetable foods, and the other because of unspecified reasons. Several favorite schedules of alternation have been reported, showing the feasibility of this dietary management to each patient's needs; however, the every other week scheme is the most frequent (40%) for our interviewed patients.

Advantages have been reported as far as compliance to dietary prescriptions, quality of life, individual freedom, and palatability of the diet was concerned. In addition, the compliance with starch made products was improved. On the other hand, patients did not complain about important troubles in the daily life or increasing individual or familial costs, although several patients reported an increased workload in cooking.

Biochemical data showed a marked reduction of total and low-density lipoprotein cholesterol serum levels (Table 2). Body weight, serum protein levels, and hematocrit levels did not change, whereas urinary urea excretion and the protein catabolic rate values decreased (Table 2). These data suggest an overall better compliance with protein restriction as well as an adequate energy intake.

Discussion

Low-protein low-phosphorus diets can prevent or correct several uremic symptoms and some metabolic complications of chronic renal

Table 2. Biochemical Data, Protein Catabolic Rate, and Body Weight in the Studied Patients Before and During the Dietary Schedule Consisting of the Alternation Between VD and CLPD

	Before	During	*P*
Creatinine clearance, mL/min	30.4 ± 13.8	27.1 ± 13.6	ns
Serum urea, mmol/L	10.8 ± 3.8	11.1 ± 5.1	ns
Serum total proteins, g/L	66.9 ± 9.5	66.5 ± 6.4	ns
Serum albumin, g/L	38.2 ± 6.1	40.8 ± 4.7	ns
Serum total cholesterol, mmol/L	4.93 ± 0.73	4.21 ± 0.72	<.001
Serum HDL cholesterol, mmol/L	1.14 ± 0.47	1.04 ± 0.26	ns
Serum LDL cholesterol, mmol/L	3.11 ± 0.67	2.39 ± 0.75	<.001
Serum triglycerides, mmol/L	1.93 ± 0.89	2.02 ± 1.08	ns
Hematocrit	0.358 ± 0.053	0.362 ± 0.043	ns
Hemoglobin, mmol/L	7.50 ± 0.99	7.38 ± 0.74	ns
Serum total calcium, mmol/L	2.35 ± 0.1	2.37 ± 0.2	ns
Serum phosphorus, mmol/L	1.03 ± 0.19	1.06 ± 0.23	ns
Serum sodium, mmol/L	141 ± 2	140 ± 2	ns
Serum potassium, mmol/L	4.6 ± 0.5	4.8 ± 0.7	ns
Urea proteins, g/day	1.3 ± 1.1	1.1 ± 1.4	ns
Urea excretion, g/day	13.4 ± 5.8	9.5 ± 3.3	<.05
Body weight, kg	74.2 ± 10.0	73.3 ± 11.0	ns
PCR, g/day	53.3 ± 18.0	41.9 ± 11.0	<.01
PCR, g/day/kg	0.69 ± 0.19	0.56 ± 0.10	<.05

Abbreviations: ns, not significant; HDL, high-density lipoprotein; LDL, low-density lipoprotein; PCR, protein catabolic rate.

failure, but the successful use of a protein-restricted diet largely depends on good compliance with dietary prescriptions.[18,19] Moreover, if the diet or monitoring for compliance is inadequate, patients are at risk of malnutrition and loss of lean body mass.[18] These are the main reasons why physicians and dietitians must give patients all the possible tools to correctly follow dietary prescriptions.

Evidence suggests that vegetable-based low-protein diets are as adequate as animal-based low-protein diets for patients with mild to moderate chronic renal failure.[1,9,16] However, in the long run, the lack of meat dishes with the former and the lack of normal bread or pasta with the latter hinder a good compliance to dietary prescriptions.

The present study shows that a dietary management consisting of an alternation between a CLPD and a VD is well accepted by the majority of patients, mainly because it provides more variety, it is not too repetitive, and it is more adaptable for leading an active life. It ameliorates the overall compliance to dietary treatment because neither meat nor cereals are excluded for long periods of time, and the chance to avoid eating starch-made artificial foods, especially during holidays, at work, or at restaurant, makes the diet easier to follow. Then the quality of life and familial and individual freedoms are favorably affected, as well as some psychologic problems of dieting.

In addition, this alternated dietary regimen is more easily adaptable to the patient's needs at work and during free time because the patients themselves have more choices as far as the type of foods and the times of diet are concerned. For example, as the wish (or necessity) of avoiding starch-made foods and/or of eating normal bread and pasta arises, the VD may be consumed. Conversely, as the lack for meat dishes arises, the CLPD may be eaten. In this way, the monthly requirement of starch-made foods is reduced and either social or individual costs can be lowered.

The every other week alternation schedule was the favorite one used by the interviewed patients. This also confirms our concerns about alternating VD and CLPD on the same day. In fact, the latter schedule could be misleading for some patients, especially at the first approach to dietary modifications, and favor inadequate compliance with overall dietary prescriptions.

As a whole, the taste and palatability of the diet was improved in many cases without a significant increase in the trouble of cooking or in the every day life linked to this dietary schedule, especially for people of Mediterranean areas where the great availability of vegetables and of pasta-based dishes make it easier to carry out a VD. As expected, changing from a low-protein diet, no relevant biochemical modifications have been found during the period of alternation between the CLPD and VD. However, a significant reduction of serum total and low-density lipoprotein cholesterol levels has been observed. This can be attributed to the higher unsaturated/saturated fatty acid ratio and to the lower cholesterol intake during the VD periods, and probably to a better compliance during the CPLD periods. Actually, an overall better compliance with protein restriction has been documented by the lower urinary urea excretion and by the estimation of dietary protein intake. In conclusion, a dietary regimen based on the alternation between the CLPD and the VD seems to be well accepted by patients with chronic renal failure and it could present a practical chance for many patients following long-term dietary protein restriction.

References

1. Giovannetti S: Low-protein diets for chronic renal failure, in Giovannetti S (ed): Nutritional Treatment of Chronic Renal Failure. Boston, MA, Kluwer, 1989, pp 179-190

2. Walser M, Mitch WE, Maroni BJ, et al: Should protein intake be restricted in predialysis patients? Kidney Int 55:771-777, 1999

3. Barsotti G: Effects of dietary therapy on uremic symptoms and complication, in Giovannetti S (ed): Nutritional Treatment of Chronic Renal Failure. Boston, MA, Kluwer, 1989, pp 235-239

4. Maschio G, Oldrizzi L, Tessitore N, et al: Effects of dietary and phosphorus restrictions on the progression of chronic renal failure. Kidney Int 22:371-376, 1982

5. Ihle BU, Becker GJ, Whitworth JA, et al: The effect of protein restriction on the progression of renal insufficiency. N Engl J Med 321:1773-1777, 1989

6. Klahr S: Lessons from the modification of diet in renal disease study. J Nephrol 7:136-137, 1994

7. Tom K, Young VR, Chapman T, et al: Long-term responses to dietary protein restriction in chronic renal failure. Am J Physiol 268:E668-E677, 1995

8. Kopple JD, Levey AS, Greene T, et al: Effect of dietary protein restriction on nutritional status in the Modification of Diet in Renal Disease (MDRD) study. Kidney Int 52:778-791, 1997

9. Barsotti G, Morelli E, Cupisti A, et al: A low-nitrogen low-phosphorus vegan diet for patients with chronic renal failure. Nephron 74:390-394, 1996

10. Elfert G: Vegetarian diets, in Walser M, Imbembo AL, Margolis S, et al (eds): Nutritional Management. Philadelphia, PA, Saunders, 1984, pp 31-35

11. Grundy SM: Management of hyperlipidemia of kidney disease. Kidney Int 37:847-853, 1990

12. Giovannetti S, Cupisti A, Barsotti G: The metabolic acidosis of chronic renal failure: Pathophysiology and treatment. Contrib Nephrol 100:48-57, 1992

13. Kontessis P, Jones S, Dodds R, et al: Renal metabolic and hormonal responses to ingestion of animal and vegetable proteins. Kidney Int 38:136-144, 1990

14. Williams AJ, Baker F, Walls J: The effect of varying quantity and quality of dietary protein intake in experimental renal diseases in rats. Nephron 46:83-90, 1987

15. Margetts BM, Beilin LJ, Vandongen R, et al: Vegetarian diet in mild hypertension: A randomized controlled trial. Br Med J 293:1468-1471, 1986

16. Soroka N, Silverberg DS, Greemland M, et al: Comparison of a vegetable-based (soya) and an animal-based low-protein diet in predialysis chronic renal failure patients. Nephron 79:173-180, 1998

17. Maroni BJ, Steinman TI, Mitch WE: A method for estimating nitrogen intake in patients with chronic renal failure. Kidney Int 27:58-65, 1985

18. Mitch WE, Maroni BJ: Nutritional considerations in the treatment of patients with chronic uremia. Miner Electrolyte Metab 24:285-289, 1998

19. Barsotti G, Cupisti A, Ciardella F, et al: Compliance with protein restriction: Effects on metabolic acidosis and progression of renal failure in chronic uremics on supplemented diet. Contrib Nephrol 81:42-49, 1990