FRESENIUS MEDICAL CARE

Can an intradialytic exercise programme decrease serum phosphorus levels in haemodialysis patients?

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NephroCare

Presentation outline

1. Introduction
2. Objectives
3. Methods
4. Results
5. Conclusion

Introduction (1/3)

Lower extremities = Low-flow regions

EXERCISE

↑ Blood flow

↑ Cardiac output

Muscle vasodilation

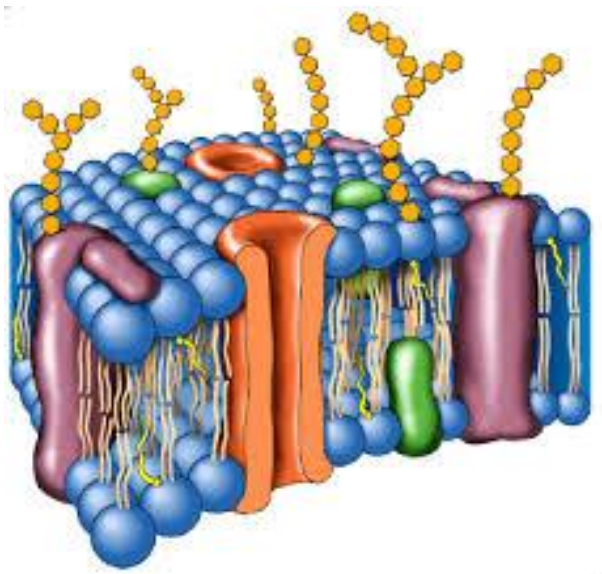
Dilated capillaries

+ Extensive surface area

Larger membrane pore size

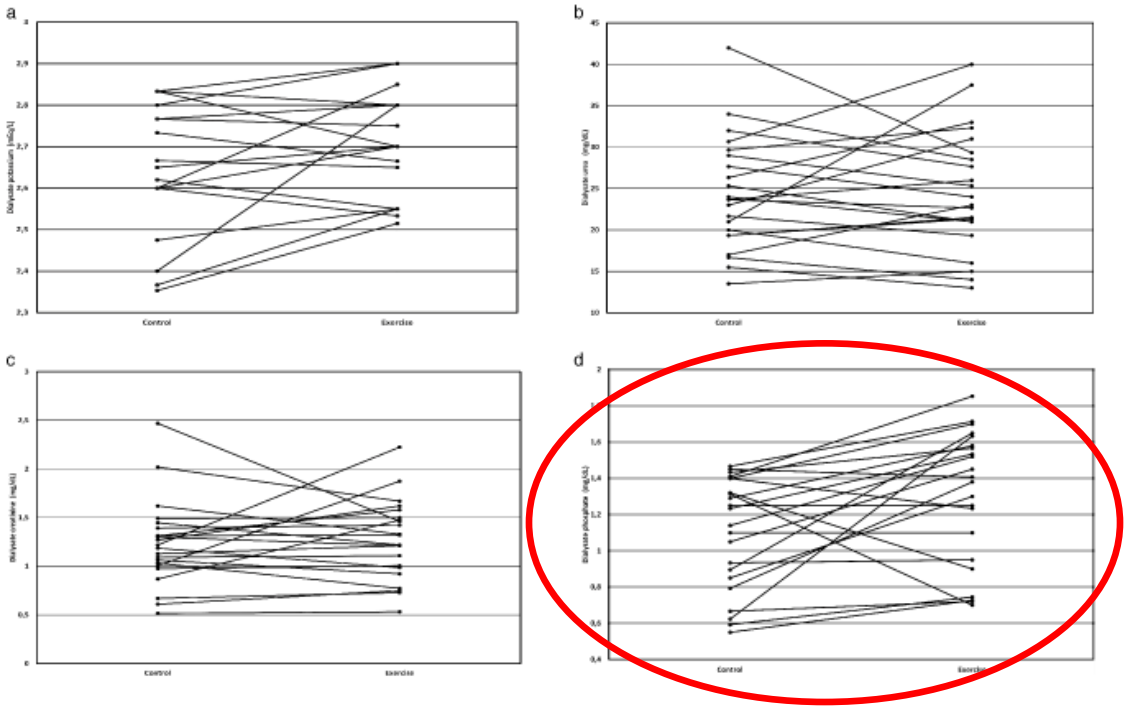
↑ Intercompartmental mass transfer coefficient

+ Solutes to vascular compartment



Introduction (2/3)

→ ***Phosphate removal in dialysate during a physical exercise session was significantly higher (5.6 versus 5.1 mg/min.) than during control sessions (p=0.04)***



ORCY , R. [et al] – **Aerobic exercise increases phosphate removal during hemodialysis: A controlled trial**. *Hemodialysis International*, 18:450-458, 2014;

Introduction (3/3)

→ ***Exercise was more efficacious than increasing dialysis time for phosphate reduction rate (8.6 versus 5.0%)***

Measure	Trial			p	Effect size (*d*) exercise vs. control	Effect size (*d*) time vs. control
	CONTROL	EXERCISE	TIME			
Urea						
eKt/V_{urea}	1.33 (0.18)	1.36 (0.24)	1.48 (0.28)[a]	0.020	0.2	0.8
spKt/V_{urea}	1.51 (0.19)	1.54 (0.24)	1.73 (0.27)[a, b]	<0.001	0.2	1.2
Urea reduction ratio, %	73 (4)	74 (5)	77 (5)[a, b]	<0.001	0	1
Dialysate urea content, mmol	284 (126)	288 (131)	302 (165)	0.96	0.04	0.1
Urea rebound ratio, %	6 (2)	5 (3)	6 (4)	0.52	0	0.5
Creatinine						
Creatinine reduction ratio, %	66 (5)	67 (6)	69 (6)[a]	0.020	0.4	0.6
Dialysate creatinine content, µmol	4,525 (4,852)	4,553 (4,725)	4,586 (3,926)	1.00	0.007	0.01
Creatinine rebound ratio, %	10 (4)	10 (4)	9 (3)	0.88	0	0.25
β_2M						
β_2M reduction ratio, %	50 (10)	53 (7)	58 (11)	0.090	0.3	0.7
Dialysate β_2M content, mg/dl	140 (82)	153 (83)	167 (100)	0.13	0.2	0.3
β_2M rebound ratio, %	16 (10)	11 (6)	11 (4)	0.12	0.5	0.5
Phosphate						
Phosphate reduction ratio, %	50 (17)	59 (10)[a]	55 (12)	0.03	0.5	0.3
Dialysate phosphate content, mmol	22 (6)	28 (18)	27 (16)	0.52	0.9	0.7
Phosphate rebound ratio, %	26 (19)	20 (12)	29 (28)	0.45	0.4	0.2

Effect sizes (Cohen's *d*) can be interpreted as small <0.3, medium <0.5, or large >0.8. Statistical significance was determined by repeated measures ANOVA. Data are mean (SD).

CONTROL = Routine HD (n = 11); EXERCISE = intradialytic cycling (n = 11); TIME = HD time increased by 30 min (n = 11).
[a] Significantly different to control trial ($p < 0.05$). [b] Significantly different to exercise trial ($p < 0.05$).

KIRKMAN, D. [et al] – **Interaction between Intradialytic Exercise and Hemodialysis Adequacy**. *American Journal of Nephrology*, 38:475-482, 2013;

Objectives

1. To evaluate the influence of our Intradialytic Exercise Programme (IEP) on phosphorous levels in haemodialysis patients at NephroCare Coimbra

2. To assess the influence of our IEP on phosphate binders prescription in NephroCare Coimbra´s patients

Methods (1/2)

- **Quantitative, observational, correlational and retrospective study**

Inclusion criteria	Exclusion criteria
1 - Ability to perform the exercises TSTS and TUG; 2 - Comply with treatment 3 times a week and effective time 240 minutes dialysis; 3 - OL-HDF treatment; 4 - FXCordiax 600 dialyzer (Fresenius Medical Care); 5 - HD time >2 months. 6 - Medical evaluation: Electrocardiogram and echocardiogram;	1 - Qb < 350mL/min; 2 - Vascular access to HD - central venous catheter; 3 - Intradialytic complications in the last 2 months; 4 - History of acute myocardial infarction or angina pectoris, valvular disease, stroke within the last 6 months and arrhythmia; 5 - Medical contraindicate exercise programme;

Methods (2/2)

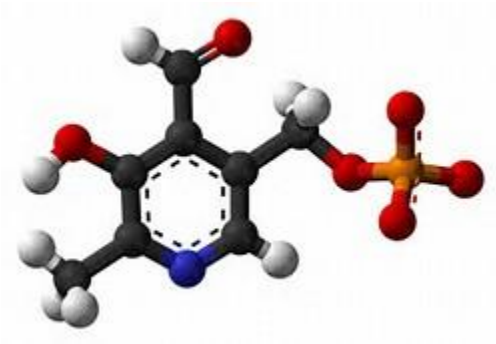
n=36

Exercise group: n=18

- *A*erobic intradialytic exercise on a cycle ergometer for 30-60 minutes during the first two hours of treatment
- Several strengthening and endurance exercises
- The effort was monitored by the Borg's Subjective Perceptual Scale (12-15 in a 6-20 scale)
- Duration of the program: 2 years

Control group: n=18

- Without intervention or participation less than 1 month



Results (1/8)

Table 1 *– Sample description*

		Exercise		Control	
		n	%	n	%
Gender	Female	8	44.4	7	38.9
	Male	10	55.6	11	61.1
Diabetes	Yes	5	27.8	5	27.8
	No	13	72.2	13	72.2
Vascular Acess	AVF	17	94.4	16	88.9
	Graft	1	5.6	2	11.1

Results (2/8)

Table 2 *– Sample description (cont.)*

	Exercise	Control	*P*
Age (y)	61.78	65.78	*0.181*
HD vintage (y)	4.50	4.11	*0.864*
Phosphorus before IEP	4.25	4.72	*0.406*
Daily dose of *Calcium acetate/ Magnesium carbonate*	1,005.00	893.33	*0.571*
Daily dose of *Anhydrous calcium acetate*	1,320.00	1,320.00	*1.0*

Results (3/8)

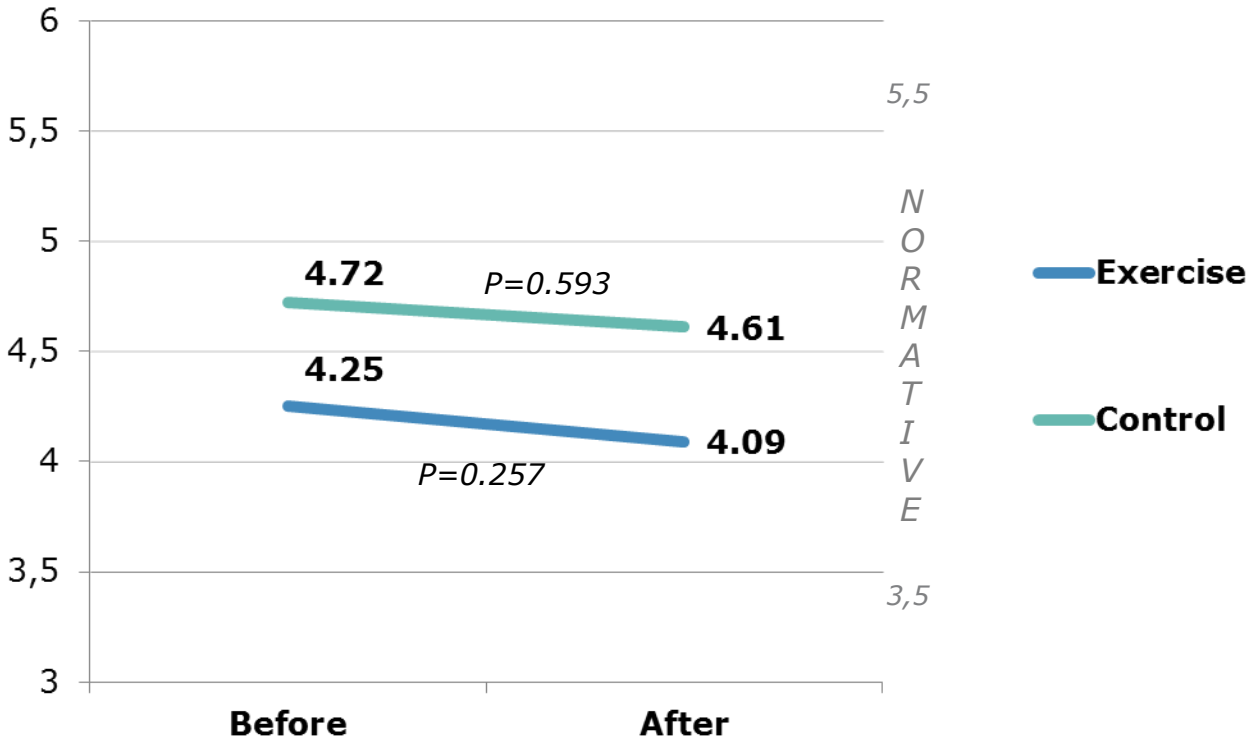


Figure 1 – Phosphorus levels for both groups before and after the IEP

Results (4/8)

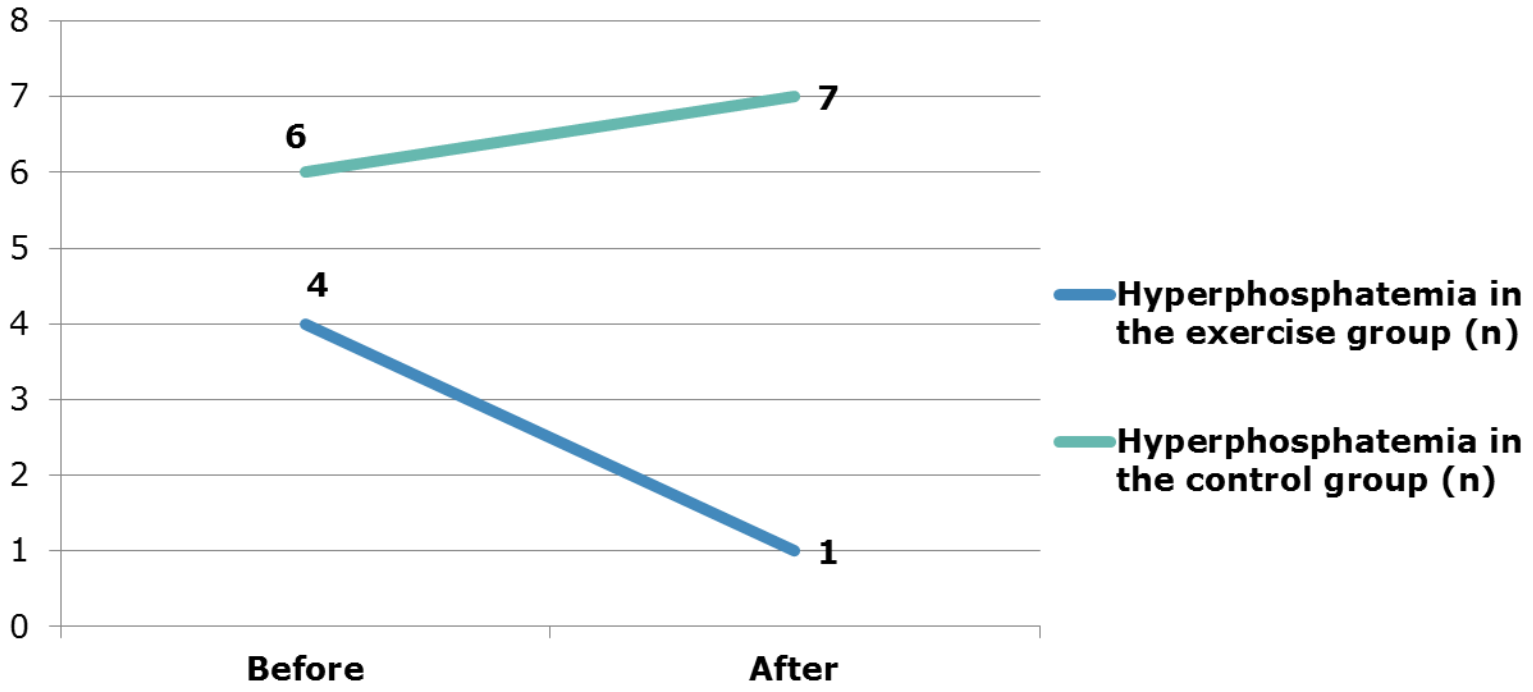


Figure 2 – Evolution of the number of hyperphosphataemic patients, before and after the IEP

Results (5/8)

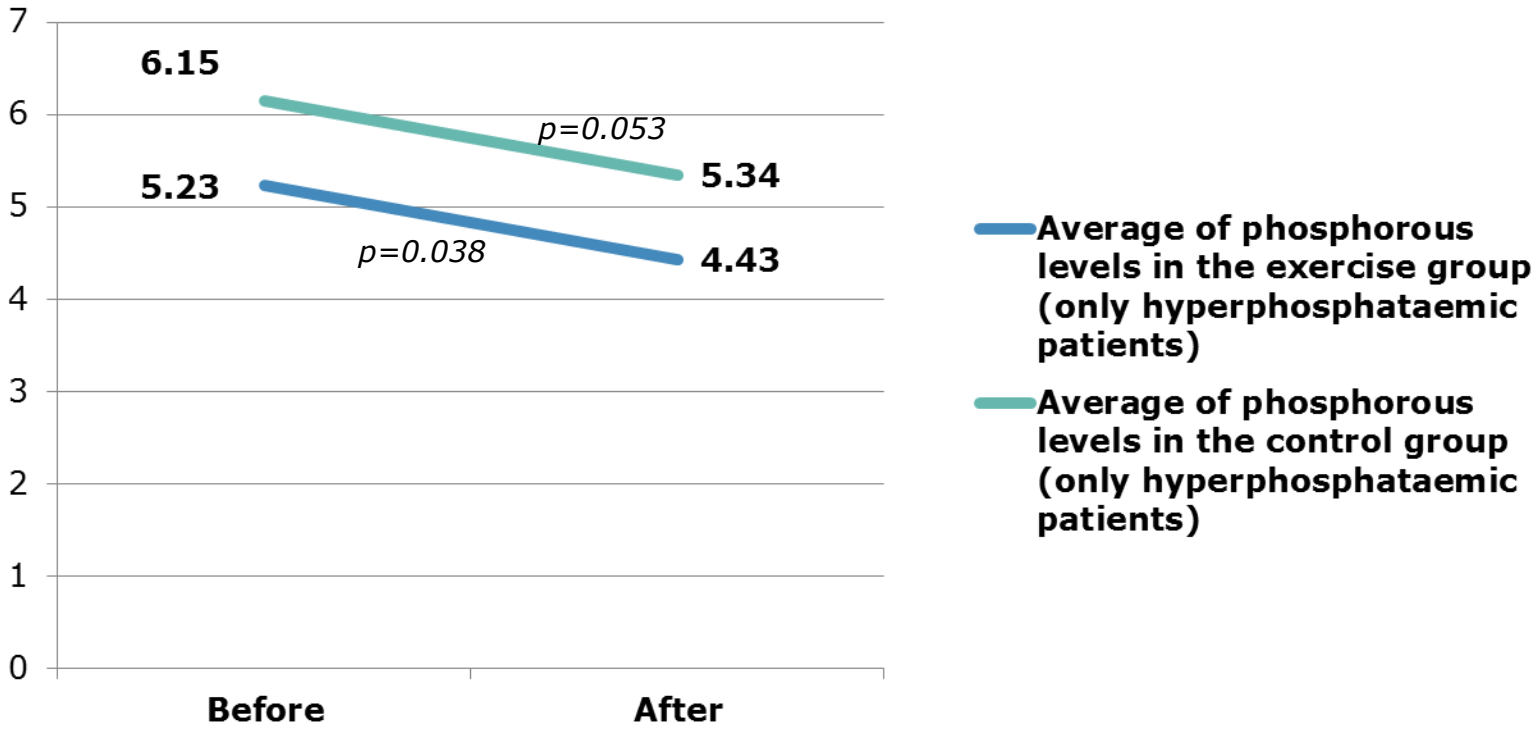


Figure 3 – Phosphorous levels of hyperphosphataemic patients from both groups before and after the IEP

Results (6/8)

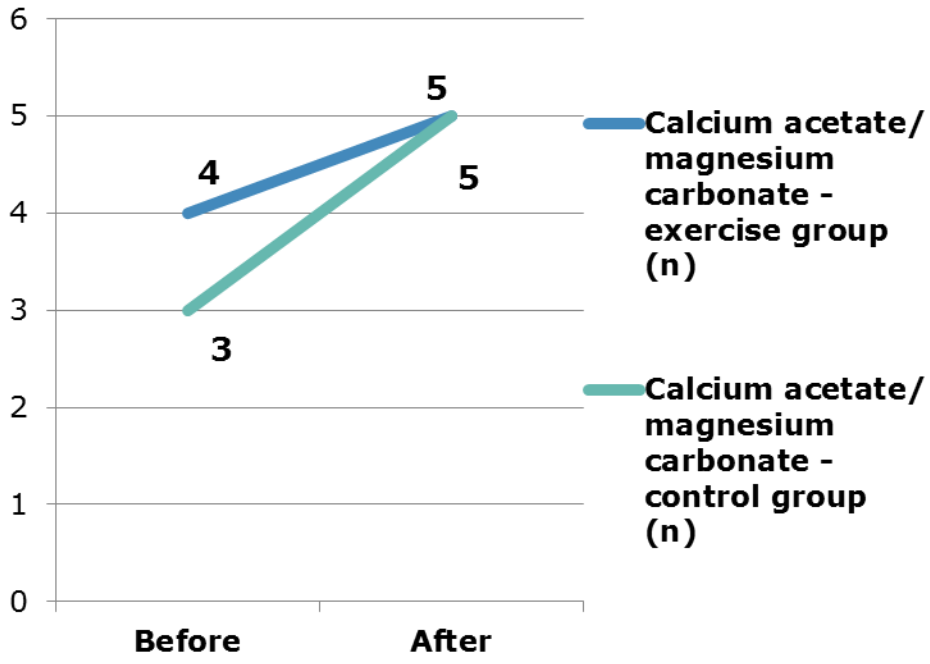


Figure 4 – Number of patients under *calcium acetate/magnesium carbonate*, before and after IEP, for both groups

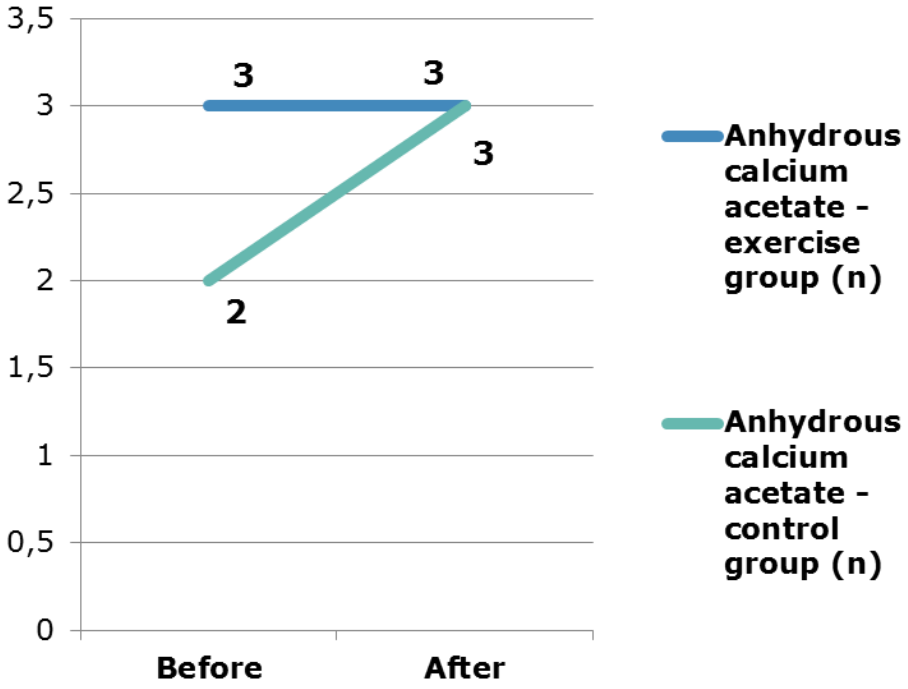


Figure 5 – Number of patients under *anhydrous calcium acetate*, before and after IEP, for both groups

Results (7/8)

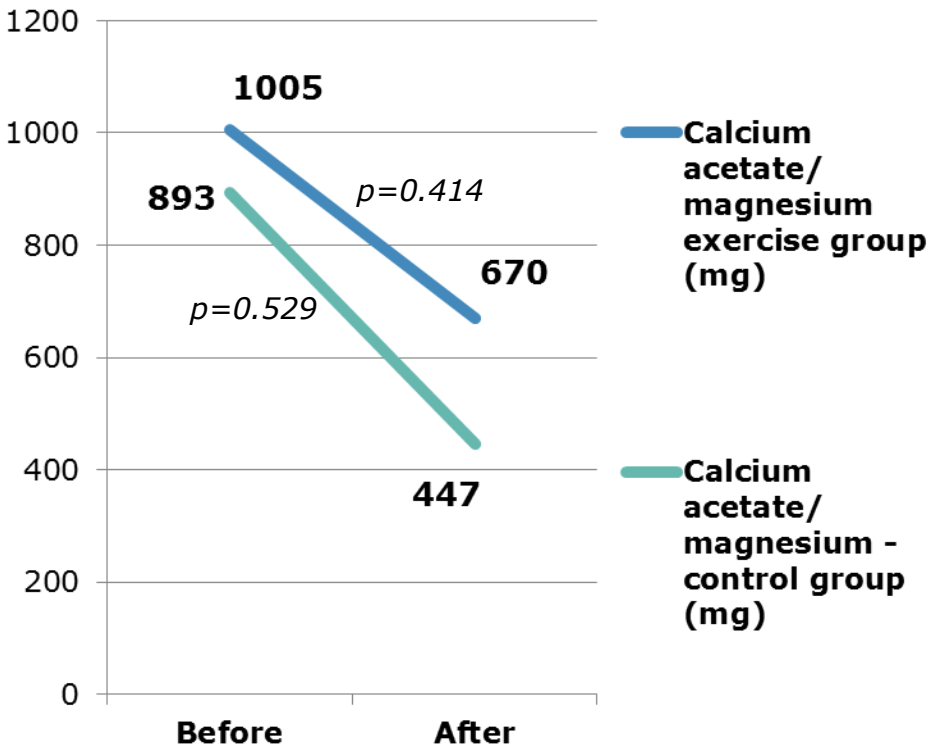


Figure 6 – Average of daily dose of *calcium acetate/magnesium carbonate*, before and after IEP, for both groups

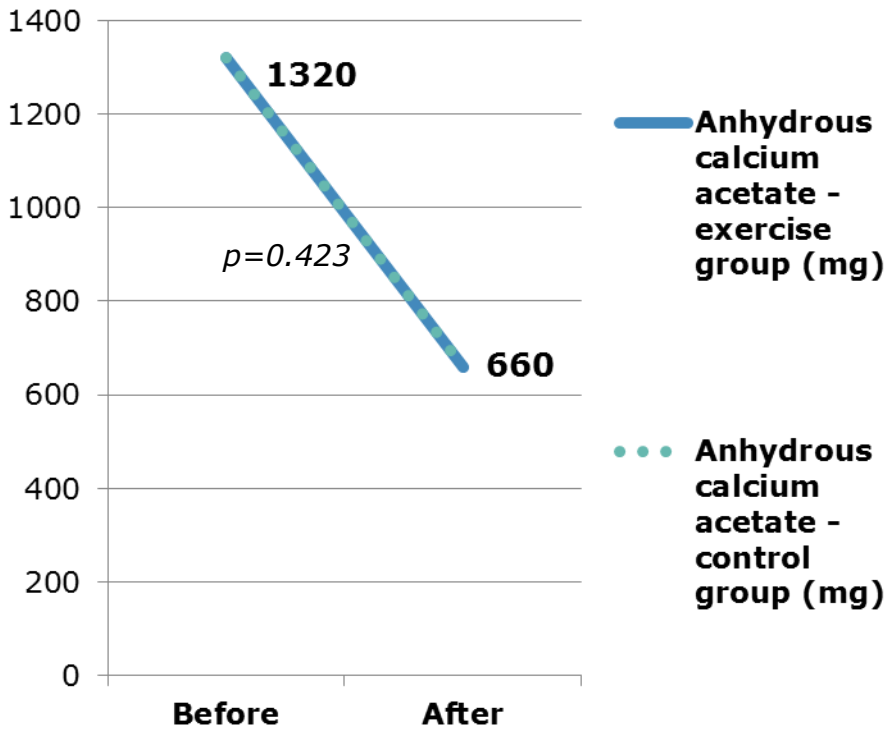


Figure 7 – Average of daily dose of *anhydrous calcium acetate*, before and after IEP, for both groups

Results (8/8)

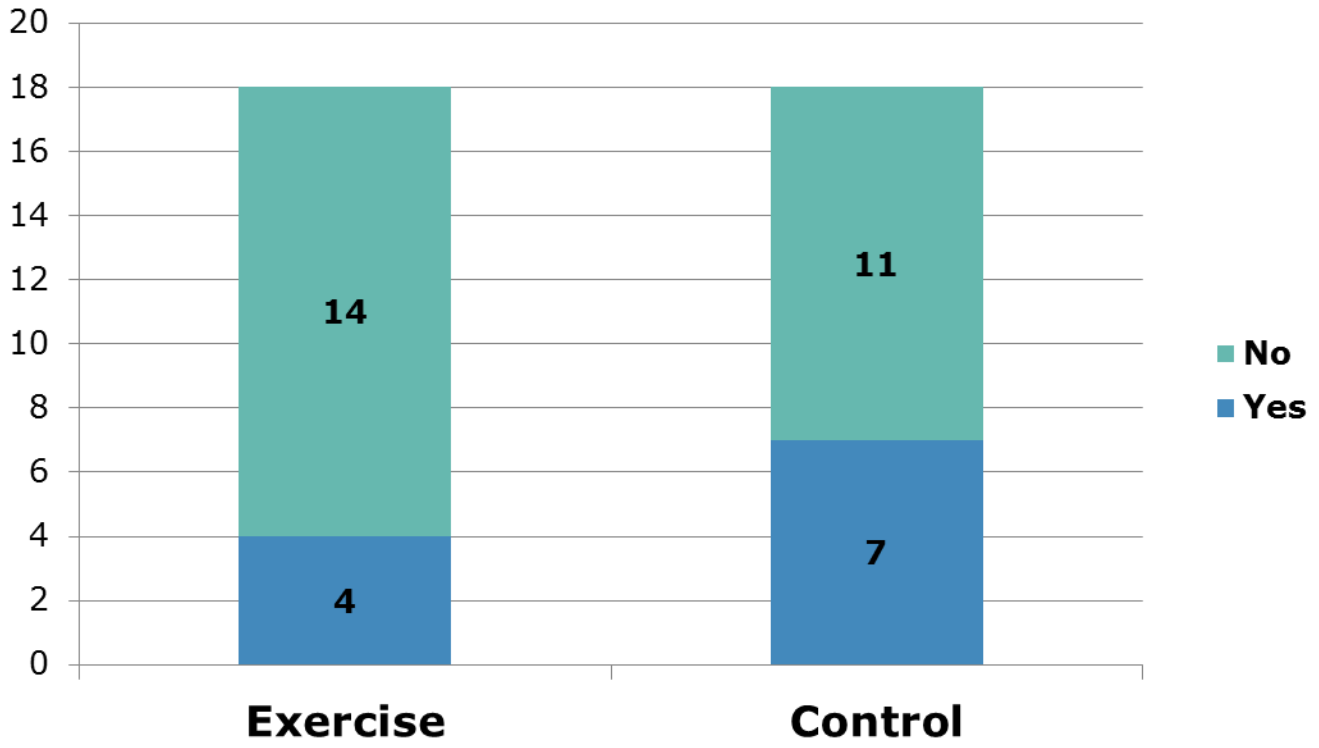


Figure 8 – Number of patients from both groups following a 6 month Education Programme for phosphorus reduction on 2016

Conclusions (1/2)

- Both groups reduced their phosphorus levels but without statistical significance
- In the exercise group, the number of patients with hyperphosphataemia was reduced, while it increased in the control group
- Both groups reduced the average of phosphate levels of hyperphosphataemic patients, but only in the exercise group this had statistical significance (p=0.038; control group: p=0.053)
- The number of patients taking phosphate binders increased in the control group
- Prescribed daily dosage of phosphate binders were reduced to a similar extent in both groups

Conclusions (2/2)

Suggestions:

- Future studies should be conducted involving a better control of the different variables, such as patient's adherence to the exercise programme and phosphate binders, as well as nutritional changes
- Comparing phosphorous levels before and after each HD session, could be a rigorous way to determinate phosphate elimination in patients on IEP

Thank You Very Much for Your Attention!

Acknowledgments

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